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Casting Gray-Iron Piston Rings by Machinery

By Ellsworth Sheldon
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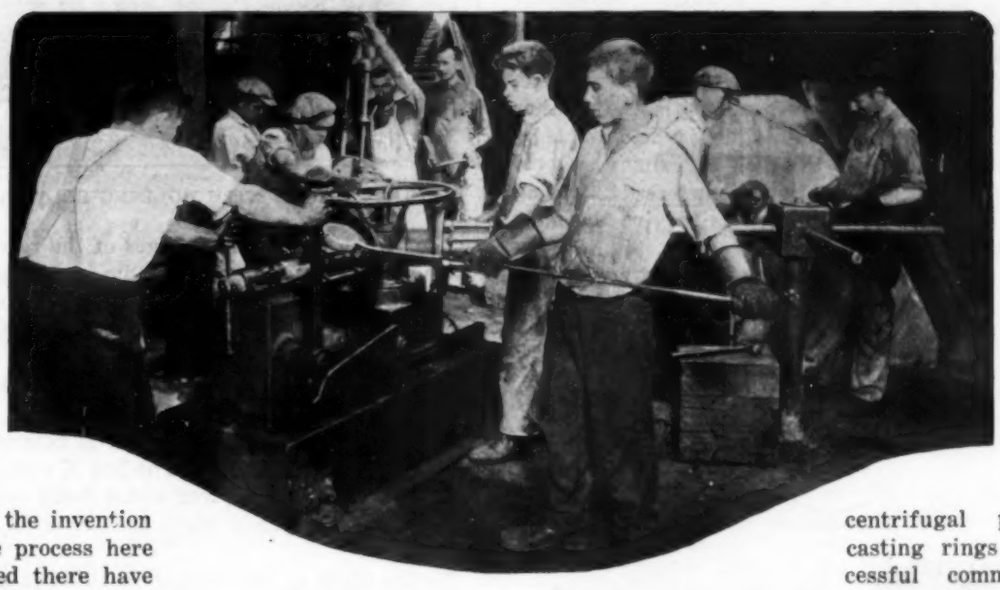


The continuous casting of gray iron in the form of piston rings is made possible by the machinery and processes herein described, in which advantage is taken of the action of centrifugal force upon the molten metal. The iron is poured into metallic molds which are rapidly rotated during the pouring, thus distributing the liquid metal evenly over their interior surface. Any number of molds of any size within the capacity of the machine may be supplied.

UNTIL the invention of the process here outlined there have been but two ways of producing gray-iron piston rings, the demand for which has grown to enormous proportions since the advent of the internal-combustion motor.

In the days when such rings were used only in steam engines they constituted a comparatively insignificant portion of the work in point of cost, and to make them a cylinder of metal was cast which was swung up in a lathe, finished inside and out as far as the chuck-jaws would allow and the rings then cut off to the required width with a parting tool.

This method produced excellent rings, but the time required to make them in this way, together with the waste of material, would make the cost prohibitive at the present time when the market demands the production of hundreds of millions of rings per annum.

Another method, and the one in common use for making piston rings, is to cast them in sand molds which are turned out by molding machines. While the output of this latter method is far greater in point of numbers than the former, production is still very slow in comparison with the machine-casting process, which will turn out from forty to fifty times as many rings per unit and which produces a casting which shows very superior characteristics.

The process, as well as all the machinery involved, is the invention of D. Sensaud de Lavaud, and his centrifugal process of casting rings is in successful commercial operation at the plant of the Standard Piston Ring Co., Newark, N. J. In the description which follows, like letters will be used to designate like parts in all of the illustrations.

The casting is done in molds which are built up of alternate rings of cast-iron and steel plate held together by bolts passing through cast-steel spiders at each end. These sections are shown in detail in Fig. 1 where *A* is the cast-iron mold ring, *B* the steel divider and *C* the spider. The outside diameter of all these parts is determined by the machine; the inside diameter of the mold ring is the same as the diameter of the piston ring to be cast (plus shrinkage); the inside diameter of the steel dividing ring must be something less than the inside diameter of the desired product. Fig. 2 is an illustration of a partially disassembled mold. It will be noted that in assembling, the mold rings alternate with the steel dividing rings so that when the completed mold is fastened together by means of the spiders and bolts, its interior presents a series of annular grooves of the size and shape of the piston rings to be cast.

The casting machine is shown in Fig. 3, where one of the molds may be seen in place. A turret *D*, which may be turned about a vertical axis by the large hand-wheel *E*, carries three large cast-iron disks, two of which may be seen at *F* and *G*, equidistantly spaced

about the face of the turret. They are mounted upon ball bearings and rotate upon a horizontal axis. From the face of each disk extend three studs or pins which support the molds during the casting operation.

The turret with its attached disks is mounted upon a hollow sliding base *H* and may be moved lengthwise of the machine by means of the hand lever *I*. The sliding base *H* is hollow and covers an electric motor, which however is fastened to the main frame of the machine and has no movement endwise. A leather friction disk *J* is mounted directly upon the armature shaft of the motor and revolves continuously at a speed of 1800 r.p.m. The edges of the cast-iron disks are beveled slightly to correspond with the leather disk, so that when the turret slide is held back by pressure upon the lever *I* the disk carrying the mold is set in motion. The relative diameters of driving and driven disks are so calculated as to give the mold a rotative speed of 1200 r.p.m.

Mounted upon a pedestal at the opposite end of the machine is a bracket carrying the spindle *K*, which

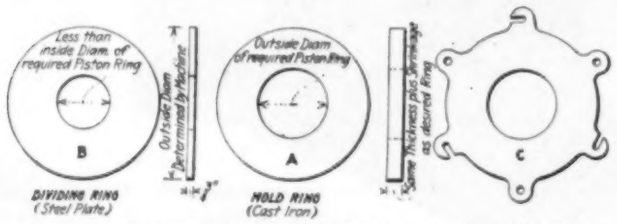

Less than inside Diam. of required Piston Ring
B
DIVIDING RING (Steel Plate)
Outside Diam. determined by Machine
Outside Diam of required Piston Ring
A
MOLD RING (Cast Iron)
Same Thickness plus Shrinkage as desired Ring
C

FIG. 1. DRAWING OF MOLD RING, DIVIDING RING AND SPIDER

consists of a metal core overlaid with refractory material to resist the heat of molten iron, a rectangular receptacle for which may be seen in that end of the spindle which extends toward the mold. This spindle has no end movement, but may be turned through one half of a revolution by the lever *L*. The receptacle is filled with molten iron by a hand ladle, and the amount which it will retain is determined by the adjustment of the setscrew *M*, which acts as a stop to the rotative movement of the spindle.

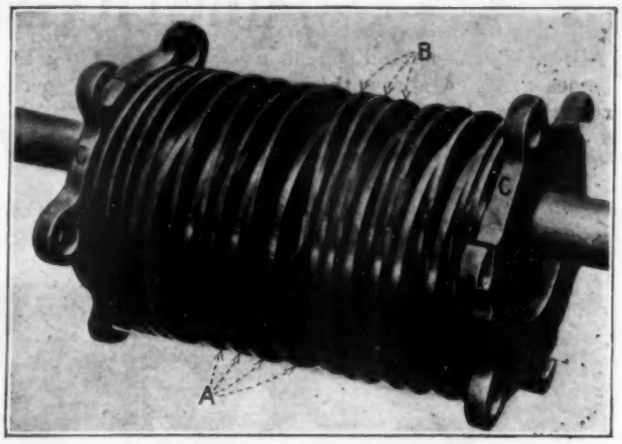


FIG. 2. A MOLD WITH HOLDING BOLTS REMOVED

Thus when the two long edges of the receptacle stand at the same level the maximum quantity of molten metal is retained by it, but if this is found to be too much, resulting in a piston ring which is too thick, measured diametrically, the amount of iron is cut down by adjusting the screw *M* so that the receptacle will not come up level, when of course the amount of molten iron that it will retain is determined by the position of its lower edge. The box *N* contains molder's sand and catches whatever metal flows over the lower edge of the receptacle when the latter is filled by the hand ladle.

To the right of the casting machine is a contrivance resembling a turnstile seen at *O* in Figs. 3 and 4. This turnstile has a cast-iron head into which is set four arms of pipe, and is so located with reference to the casting machine that one of these arms points directly to the center of the mold when the turret has been turned one step, bringing the mold to the second, or unloading-station.

At *P* in Figs. 4 and 5 is the apparatus for cooling the molds which, as they are used continuously, would, if not cooled during each cycle, accumulate so much heat as to preclude their being handled and probably cause them to be ruined. Above an open tank of coolant sunk below ground level is a skeleton wheel made up of iron bars of rectangular section. This wheel has no rim, but at the end of each spoke a piece of pipe projects laterally for a distance of about two feet, giving something of the appearance of a paddle wheel from which one side has been removed. This wheel swings upon a horizontal axis so located with reference to the sunken tank that two or three of the laterally projecting pipes are at all times under the surface of the liquid. The whole apparatus is so inclosed with concrete sides and iron covers that in the unlikely event of anything

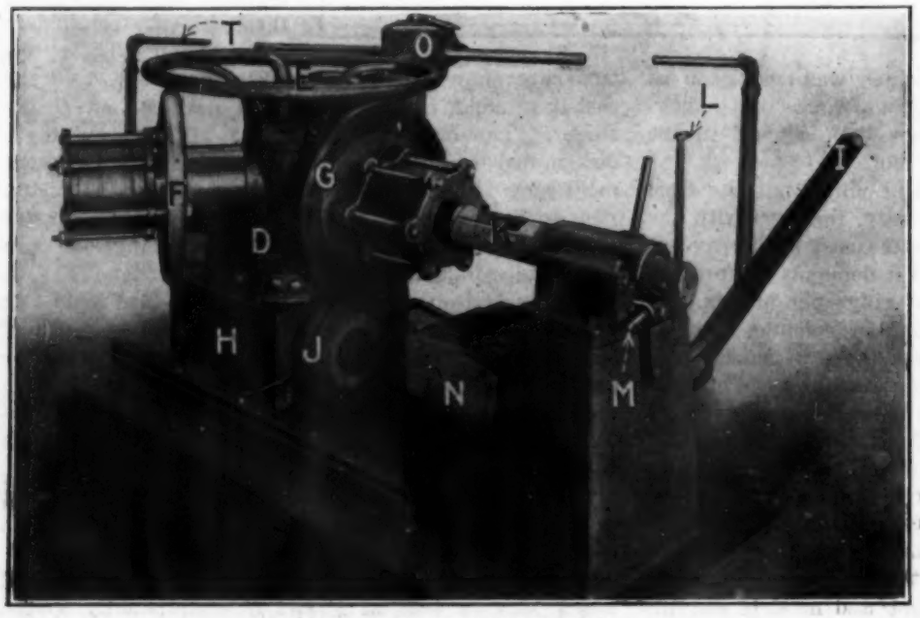


FIG. 3. THE CASTING MACHINE

taking fire, the operator at each side could close his respective door with one movement of his hand, thus cutting off the spread of the fire and smothering the flames. Fig. 4 shows this apparatus with the covers removed to give an idea of its construction.

In Fig. 5 is shown the machine for reassembling the molds. A double-acting air cylinder *Q* is operated by the hand-controlled valve lever *R* to force its plunger to right and left.

A series of loose rings (the mold with the holding bolts removed) is placed upon the bar *S*, which centers all of the rings, including the two spiders. Air is admitted to the opposite end of the cylinder, causing the plunger to compress the rings to a compact mass and holding them in this position while the three holding bolts are placed and tightened.

Meanwhile another operator has placed another set of rings in position on the opposite end of the machine and the first operator having completed the bolting up of his mold, the valve is reversed, releasing the first mold and compressing the other which the second operator now proceeds to bolt up. The action of the machine is therefore continuous, the completed molds being placed on a rack before the machine ready to be transferred to the casting machine. This rack is so located as to bring the completed molds opposite to the third or loading station of the casting machine. At the right end of the machine in Fig. 5, may be seen a mold under compression, ready for bolting, while at the left is a stack of loose rings which have just been set into the machine.

Casting Process Continuous

The casting process is therefore continuous, and can be carried on as long as molten metal can be supplied. As this is furnished at present from a small cupola, it is therefore the limiting feature, but the company is preparing to install a battery of electric melting furnaces which will be operated alternately, thus removing this limitation and making possible a constant output of from two to three thousand rings per hour.

By means of different sizes of mold sections any size of piston ring up to eight inches (the limit of the present machine) can be produced and of any desired width, and rings of the larger sizes used in steam-engine practice can be produced upon a similar machine of suitable capacity.

The width of the piston ring measured in a direction parallel to its axis is determined by the thickness of the mold section which casts it while the thickness of the ring measured diametrically is fixed by the amount of molten metal introduced into the mold. This latter is gaged for minor variations by means of the setscrew previously described. For wider variations a proper-sized receptacle is substituted by changing the spindle *K*, which can be done by releasing a binding bolt and drawing the spindle out from the rear of the bracket.

The cycle of operations is as follows. With a mold in place on the machine at station one, or casting position, and the metal ready at the cupola, the machine operator presses down the lever *I* bringing the mold-carrying disk in contact with the revolving leather disk upon the motor shaft. During the few seconds required to raise the somewhat heavy disk and mold to its full speed of 1200 r.p.m. a helper is emptying a hand ladle of molten iron into the receptacle on spindle *K*, which he fills to overflowing.

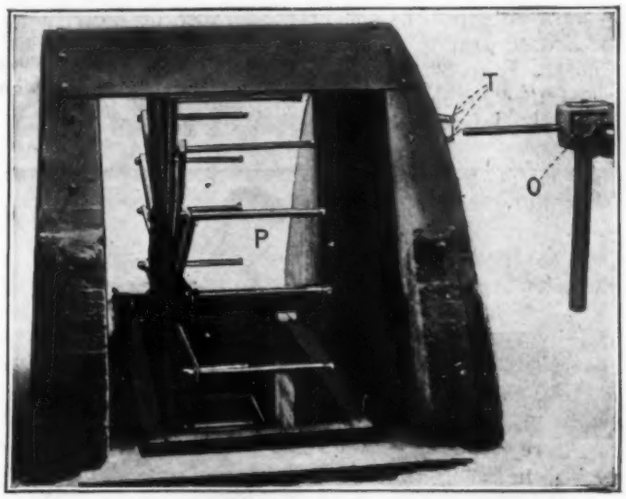


FIG. 4. APPARATUS FOR COOLING THE MOLDS

The operator then throws over the lever *I* which slides the entire turret mechanism toward him, the mold encircling the spindle *K*, which is immediately inverted, spilling the fluid iron into the interior of the rapidly revolving mold. The first forward movement of turret of course disestablishes the contact with the driving disk, but the momentum of the heavy parts would keep them in motion for some time, as they turn very easily. The molten metal delivered in an even sheet over the interior of the mold immediately flows, by virtue of centrifugal action, to the annular grooves of which the mold surface is composed, filling the grooves

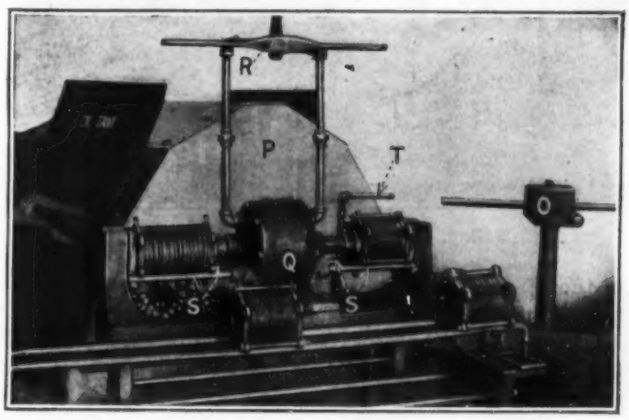


FIG. 5. THE MOLD-ASSEMBLING MACHINE

FIG. 6. MOLD SECTIONS AND HOOK FOR HANDLING THEM

to an even depth, as the preponderance of centrifugal force over gravity is so great that the latter may be ignored.

The forward movement of the turret slide is stopped in correct position for casting by a friction disk set

FIG. 7. THE ANNEALING FURNACE

in the center of the revolving iron disk coming in contact with a similar disk set in the end of the spindle *K*. As soon as the operator feels this contact he removes his hand from the lever *I*, while with the lever *L* he inverts the receptacle by turning spindle *K* half way over. A few seconds' contact with the practically cold surface of the mold serves to set the molten metal and the operator then presses down hard on the lever *I*, bringing the brake disks firmly together.

As the mold stops revolving the operator throws forward the lever, sliding the turret back until the mold-carrying disk is almost but not quite in contact with the driving disk, in which position the turret is free to turn upon its vertical axis, and a boy at the handwheel *E* turns it to the next position which brings the filled mold opposite an arm of the turnstile *O* and at the same time of course brings a fresh mold to casting position.

A boy standing at the second station is provided with a pair of heavy gloves with which he seizes the filled mold and slides it onto the arm of the turnstile. As this arm is directly in line with the center of the mold no effort is required except a straight pull to slide the mold off the three pins which supported it on the revolving disk onto the arm of the turnstile which he promptly pushes around one quarter of a turn to where two boys stand ready to disassemble the mold. Quickly knocking out the three holding bolts these boys transfer the mold one section at a time to the fixed support *T*, allowing the still hot rings to drop into wire baskets. As this disassembling is the slowest move in the cycle, two stations of the turnstile are provided for it. A boy at the cooling tank takes up the loose rings from the station *T*, using the hook *U*, Fig. 6, which serves to keep the molds together even though the bolts have been removed, and hangs them on one of the projecting arms of the cooling device, at the same time pushing the "wheel" along one step.

The reader will understand that sufficient molds are provided to keep the entire crew busy and that each of the arms on the lower half of the cooling wheel has a disassembled mold hanging upon it, three of them being immersed in the cooling tank. Sections of several of the molds are shown upon the table in Fig. 6, the several parts being lettered as in Fig. 1.

As the operator at the loading side of the cooling wheel pushes it along ready to receive the next mold, a cooled mold is raised to the level of the discharging door, where a boy lifts it off with his transfer hook and deposits it on one side or the other of the assembling machine, Fig. 5. Finally, a boy is stationed at the rack before the assembling machine to place the molds in the casting machine. Thus it will be seen that once the cycle is filled, the work goes forward without interruption, a cast being secured at an average rate of three molds per minute, and as these molds may easily make twenty rings each per cast it may readily be seen that this process possesses immense advantages over its nearest competitor even though it had nothing but rate of production to recommend it. The machine with its crew at work is shown in the headpiece of this article.

As a matter of fact, however, the rings cast by the centrifugal process possess characteristics that render them superior to sand-cast rings and are claimed to be superior to rings cut from a cylindrical casting, the

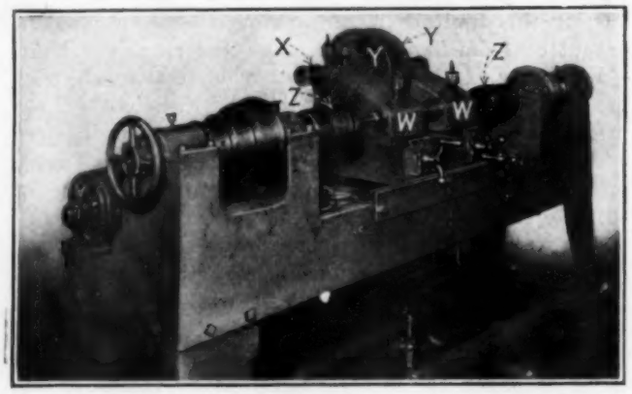


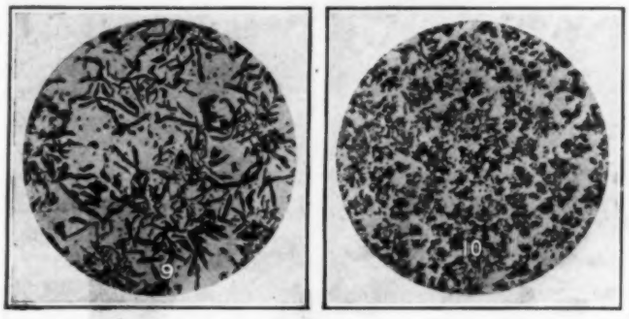
FIG. 8. MACHINE FOR GRINDING INTERIOR OF RINGS

quick swirl given to the mixture at the instant of pouring together with the heavy static pressure induced by the high velocity tending to give a density and homogeneity of metal practically unattainable in a gravity filled mold, while sand pockets, blow holes and similar defects directly due to the sand mold are avoided. As the molds are so large in proportion to the charge of molten iron, and are not allowed to accumulate heat from successive pourings, no appreciable deterioration is shown by them even after considerable service.

The rings as they come from the casting machine are very brittle, being in effect (though without intent) chilled castings, and it is necessary in order to complete the process to put them through a tempering operation. For this purpose the annealing furnace shown in Fig. 7 is provided. The construction is such as to carry out the almost automatic progress of the ring casting operation from start to finish. A central vertical tube (changeable to suit different diameters of rings), open at top and bottom, is surrounded by a jacket. Fuel oil is used to fire the furnace, the heat being confined to the annular space between the jacket and the inner tube which latter is raised to the required temperature near the middle of its length, leaving the upper and lower ends comparatively cool.

The piston rings are fed automatically to the top of this central tube at the rate of about 20 per minute and their passage through the tube permits the slow heating to the required temperature and the slow cooling which is necessary to the tempering processes.

The rings are prevented from falling out of the tube by a set of steel finger springs arranged basket-



FIGS. 9 AND 10. PHOTOMICROGRAPHS AT 90 DIAMETER

wise around the lower end of the tube with sufficient tension to hold the weight of the column of rings in the tube, but not sufficiently strong to prevent the rings from being pushed through by the feeding mechanism; thus after the tube has been filled, the introduction of each ring at the top by the automatic feeding device pushes one ring out at the bottom. On first starting the furnace the lower part of the tube will be filled with unannealed rings, which are picked up as fast as they come out and returned to the hopper until the furnace begins to deliver annealed rings.

The rings as they come from this machine casting process are bright, smooth, and free from the imperfections which are the result of the regular sand-casting method, therefore no machining is required except grinding, and as they can be cast within very accurate limits, little grinding is necessary, the grinding allowance being in some cases as low as 0.005 on a side.

It is not the purpose of the Standard Piston Ring Co. to furnish finished rings, but rather to furnish castings to the manufacturer of engines, and therefore they are not equipped to do any machining upon their product except to grind the interior surface of the ring which is the only part of the casting showing any degree of roughness. For this grinding the double-head machine shown in Fig. 8 has been developed and put into use.

The main slide *V* carries two independently adjustable heads *W*, each spindle driven by belts through the medium of the pulleys *X* and *Y* upon a countershaft carried in each head. These countershafts are driven from a drum overhead. The main slide has a traverse movement of about 8 in. which is driven by the small motor which may be seen upon the machine bed to the left. The work-carrying spindles are driven from the same overhead counter as are the grinding spindles and have three-step cones to provide for different diameters of rings.

The chucks *Z* for holding the work are cast-iron cylinders having longitudinal ribs on the interior surface and a steel retaining ring screwed to the front end. Nearly half of the chuck body is cut away to allow the placing of the rings from the side. The rings rest upon the finished surface of the ribs before mentioned, which brings them accurately to center and they are then tightened in place by an annular plunger, operated by the handwheel seen upon the outer end of the spindle, pressing them against the steel ring on the front end of the chuck. Chucks and pressure rings must of course, be provided for each size of piston ring to be ground. This method of holding would hardly answer for rings made in sand molds for the reason that slight irregularities of surface and variations in thickness would throw the stack of rings out of true, but the machine castings are practically finished as they come from the process, and may be handled in the same manner as if they were machined rings.

Comparative Tests

For the purpose of determining the characteristics of the iron produced in this way, a series of comparative tests were conducted at Columbia University upon rings cast by the machine process and rings cast from the same melt in sand molds, the result disclosing some very surprising variations.

While the chemical analysis of the iron was of course practically the same for each specimen the microscope showed the structural arrangement of the machine-cast ring to be much superior to the sand-cast product.

Photomicrographs of the two specimens are shown in Figs. 9 and 10 in which the difference in structure is readily apparent. This difference is no doubt due in large measure to the high static pressure of the liquid metal under the influence of centrifugal force induced by the rapid rotation, though it is of course influenced, in lesser degree, by the thorough mixing and uniform cooling to which it is subjected.

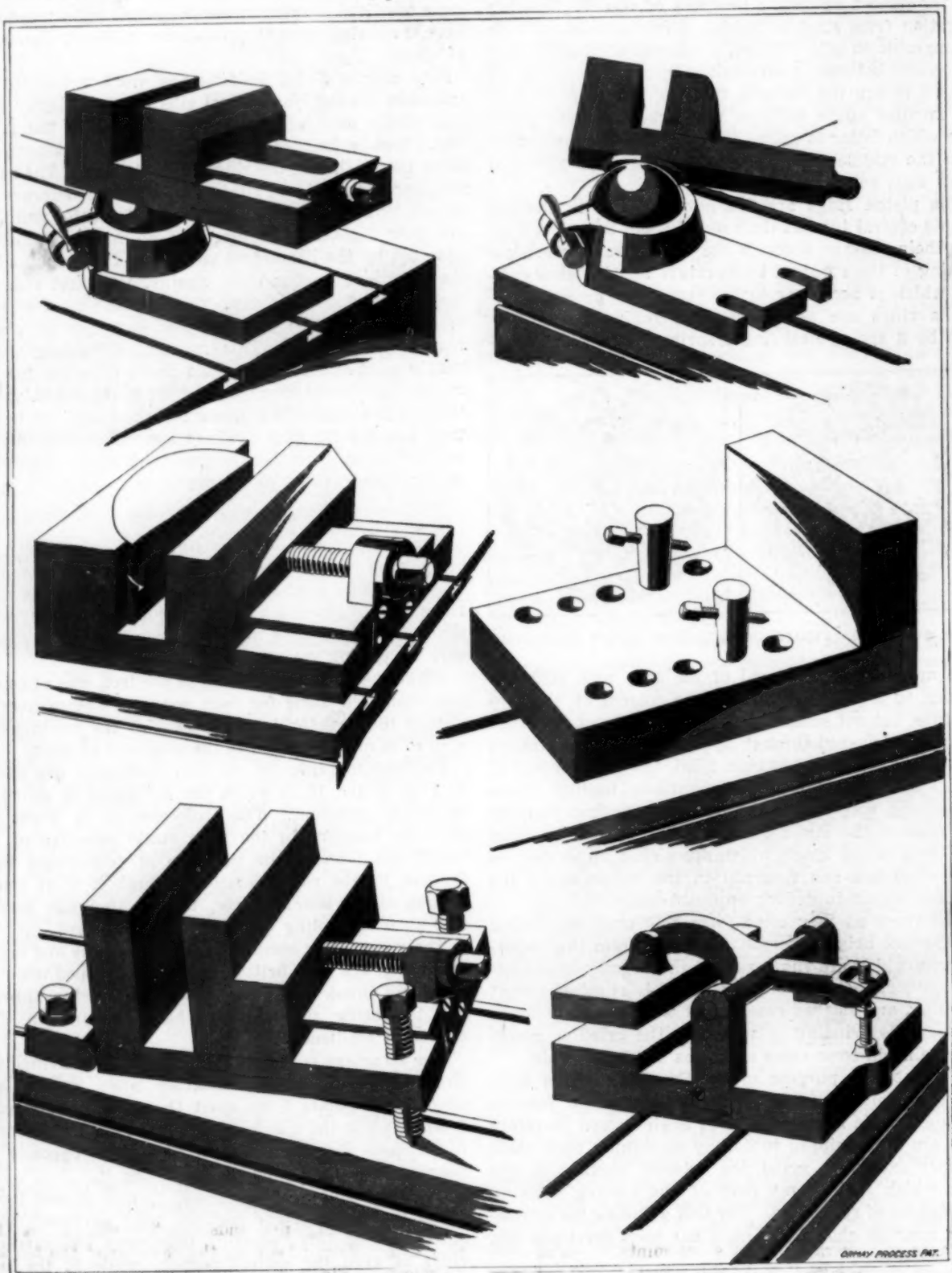
The rings, after coming from the machine and before annealing, are very brittle, and when dropped upon the floor will break like glass, but after passing through the tempering process they have acquired a high degree of resiliency.

The structure is remarkably uniform, the Brinell test showing practically no variation when applied successively to points ½ in. apart throughout the circumference, while the specimens from the sand molds were in all cases very much harder at a point opposite the pouring gate than immediately under it.

The specimens were also tested by drilling and it was found that the machine castings were uniformly more susceptible to this operation than were the sand-cast rings at even the softest portion, while at the hard part of the latter they could be drilled only by specially hardened drills.

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas



VARIOUS METHODS OF HOLDING WORK

Building Wooden Ships for the Emergency Fleet Corporation

By E. A. SUVERKROP
Associate Editor *American Machinist*

II. The Keel and Frame

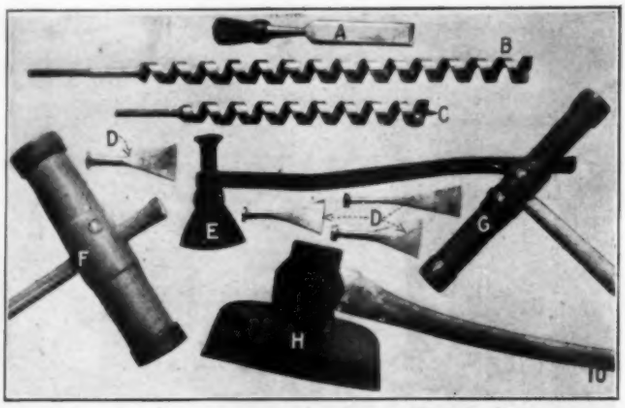
With the completion of the ways for the ships, the finishing of the molds and the reception of the timber, the various parts are laid out and construction of the ship begins.

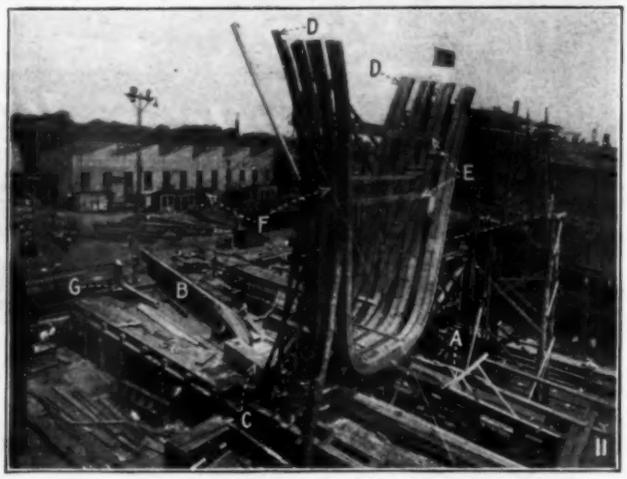
THE keel of a 3500-ton ship is roughly 250 ft. long, 16 in. wide and 14 in. deep, with an oak wearing strip 3 in. deep and 16 in. wide fastened on its bottom. As it is obviously impossible to obtain timber sufficiently long to make such a keel out of a single piece it becomes necessary to make it from a number of pieces jointed together. The method of joining work of this sort is by means of scarf joints, which consist of a pair of tapered ends overlapping each other and having through bolts riveted in place. The dimensions for these joints are usually given in the plans. The extreme end of the taper is called the "nib," and a well-known rule for the thickness of this part is 23 per cent. of the depth of the entire timber. After the scarfs are marked out, as shown at *A*, Figs. 5 and 6, they are cut with a band, jig or circular saw, or should these not be available then several cuts *B*, Fig. 5, are taken at intervals of say 1 ft. with a cross-cut saw down to a point very close to the scribed line *A* of the timber. The ship's carpenter splits off the bulk of the timber down to these cuts with an axe as shown, trims up with the adze as shown in Fig. 6 and finally finishes the joint with a plane. The final finishing should be checked from time to time with the try square to see that it is square with the sides.

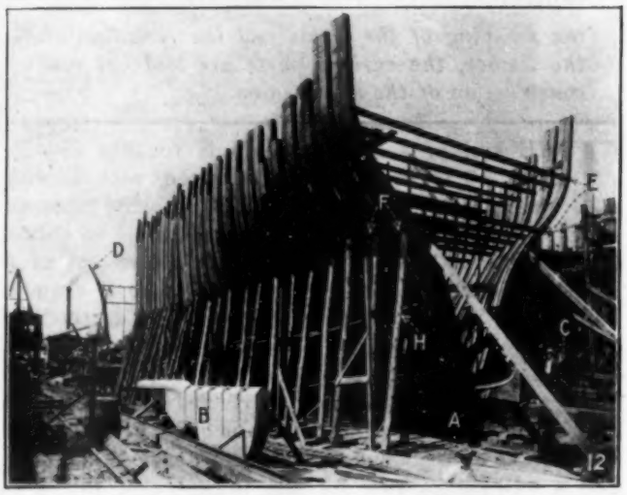
There are several types of scarf joints, those in most common use being the flat scarf, shown in Fig. 6, and the hook scarf, shown in Fig. 5. The hook scarf, as its name implies, has a hook-like projection which prevents the two parts from moving endwise away from each other.

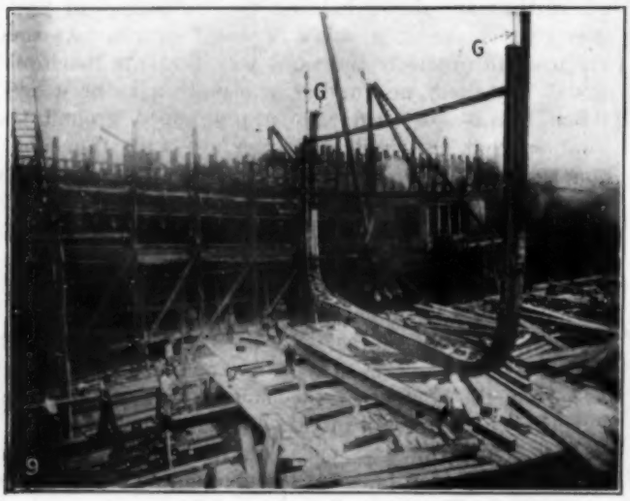
When cutting down the kerfs *B*, Fig. 5, with the saw care should be taken that the saw cut does not go past the mark or rather past the trimmed part of the joint, as a saw kerf so placed is apt to induce splitting the timber should it later be necessary to bend it into place. This bending does not of course take place in the building up of the keel, but there are many other places where scarf joints are used in shipbuilding and where bending forms a necessary part of the work. The surfaces of the joints where the timbers fit are painted before the parts are bolted together. To facilitate the operation of boring and bolting the parts of the scarf or other work together either heavy C-clamps or chains are used. The clamps are used as shown in Fig. 7, where they are shown holding the "futtocks," or parts that go to make up a ship's "frame," or rib. As they are used in precisely the same way that the machinist would use them no further explanation is necessary. When chains are used they are wrapped around the joint so that they will not interfere with the subsequent operations of boring and driving the bolts. The chains used for clamps are made of $\frac{5}{8}$ or $\frac{3}{4}$ in. iron and at one end terminate in what is called a jew's-harp, as shown in Fig. 8 at *A*. The large part permits the ordinary links of the chain to pass through while the small part is merely large enough to allow the ordinary links to enter this part of the jew's-harp edgewise as shown at *B*. When so arranged with one or more of the links *E* beyond the surface of the narrow part of the jew's-harp the chain is to all intents an endless one.

After securing the ends of the chains together, wedges are driven between the chains and the timbers, as shown in Fig. 8, forcing the scarf to proper contact. Chain clamps are used for clamping other parts be-









FIGS. 5, 6, 7, 9, 10, 11, 12 AND 13. VIEWS OF VARIOUS PHASES OF THE WORK

Fig. 5—Hook-scarf preliminary work. Fig. 6—Flat-scarf "dubbing off" with the adze. Fig. 7—Framing floor, showing use of C-clamps. Fig. 9—Framing floor, showing use of chain clamps. Fig. 10—Some ship carpenters' tools. Fig. 11—Taper frames at the bow. Fig. 12—Square and taper frames at the stern. Fig. 13—General view of the tilting jig saw

sides scarfs. Their use in the assembling of frames is shown clearly in Fig. 9. In this illustration a midship frame is being lifted preparatory to setting it in place on the keel of the ship. To the left at *B* in this illustration may be seen a part of the keel resting on the "cribbed-up" keel blocks previously referred to.

The holes for the bolts are bored $\frac{1}{16}$ in. less in diameter than the bolts which are to enter them. As previously stated the boring at this yard wherever possible is done with air drills. In Fig. 7, at *A*, one of these air drills can be seen in the partly completed hole where it

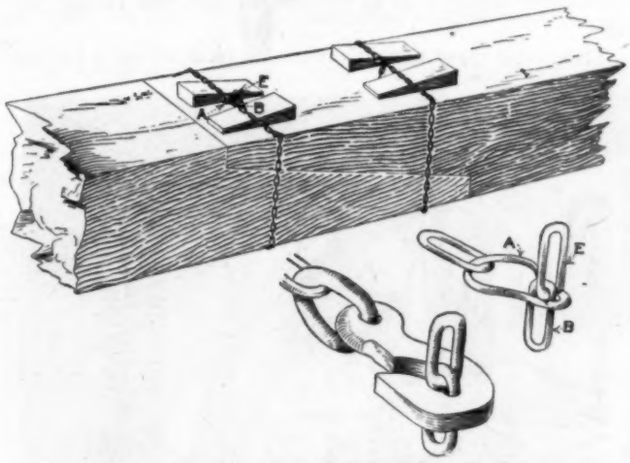


FIG. 8. CLAMP CHAINS WITH JEW'S-HARP

was left by the ship carpenter when he quit for lunch. The frame he is boring is 2 ft. thick.

Two kinds of bits are in common use by the ship carpenter, and both of them are shown in Fig. 10. The lower one marked *C* is of a type so well known that no description is necessary. It is not so much used by ship carpenters as the one shown at *B*, which bores a truer hole and is more readily removed from the hole when it becomes necessary to clear the hole of chips. This type of auger, having no leading screw, is commonly termed "barefoot." In boring large and deep holes such as are necessary in work of this character it is frequently necessary to clear the hole and bit of cuttings. With the air drill this is a simple matter, the operator merely working the whole device outward with a sort of pumping motion. A lubricant of oil or grease applied to the point of the auger facilitates the operation of hole boring. The lubricant should be kept in a shallow tin so that the bit end can be dipped into it. With these augers it is not necessary to bear heavily on them in order to make them cut. If they are sharp the friction of the chips in the helical grooves of the bit will give ample feed to the tool. A $\frac{3}{4}$-in. hole can be bored in hard yellow pine 18 in. deep in 15 seconds.

Occasionally an auger gets stuck and will not back. The only thing to do in such an event is to fasten a clamp around the shank and with a crowbar or other lever pull it out.

After the keel has been jointed up and laid, the center distances of the frames, or ribs, are laid off, as are also the location of the stempost and the sternpost, which are respectively the uprights at the front, or bow, and back, or stern, of the ship.

At the bow and also at the stern of the ship a certain amount of solid wood is built up in layers on the keel and through-bolted to it. These are called the "deadwood," and because of the deadwood certain of the frames at the bow and stern do not cross the keel. These frames are technically termed "cant" frames. The remainder of the frames are called "full" frames, and they reach from side to side of the ship. In the center of the ship's length, or as it is termed "amidships," the edges of the frames are parallel with the length of the ship or square with a line drawn across the ship's length. Such frames are called square frames. Figs. 7 and 9 show two views of a square frame. At the ends of the ship where it tapers toward the bow and stern the edges of the frames taper and these frames are termed taper frames.

In Fig. 11 one can see the taper frames at the bow; the one furthest to the left marked *D* was the first frame to be erected. At *A* in this illustration is shown a large square used for setting the frames square with the keel. At *B* is shown the stempost. One can get a very good idea of the size of this piece by comparing it with the man sitting beside it. At *C* is the shaft log built up of four heavy pieces of timber and cross-bolted in both directions, after which it is rough-bored as shown.

In Fig. 12 are shown in the foreground the taper frames of the stern. To the extreme left at *D* is shown the first frame erected at the bow, which was referred to in connection with Fig. 11 in the preceding paragraph. At *A*, Fig. 12, is shown the hackmatack knee, which supports the sternpost and braces it where it meets the keel. At *B* is shown the rudder for the second ship launched at this yard.

Building the Frames

The frames for ships of this size are built up and not bent as are those for small boats. As they are built up it is necessary, for the sake of strength, to build them up of two layers, and as it is impossible to get natural timbers of the required curvature, straight wood is used and sawed to the required shape. The two layers are arranged so that the joints are "broken," as in brick laying; that is to say, where a joint occurs in one layer it is always backed up by a solid piece of timber in the other layer. The timbers are clamped together for boring in exactly the same manner as previously described in connection with scarf joints, i.e., with chains and wedges or with heavy C-clamps. After boring with the air drill the parts, or "futtocks" as they are called, are securely fastened with treenails and iron bolts. It will of course be remembered that the various parts that go to make up the frame have been previously laid out to a pattern or mold by the mold-loft's man. He also gives each its number to identify it with the particular frame to which it belongs and also its position in the frame. The bevel on the piece is also marked to act as a guide for the operator of the band or jig saw where it will be beveled and sawed to shape at one operation. In certain pieces the bevel changes from end to end of the piece. This gradual change in bevel can also be taken care of by the machine operator.

In Fig. 13 is shown a tilting jig saw used to cut curves and bevels in heavy timber. Such a beveled and curved piece can be seen in this illustration at *A*. Within the shed *B* is the tilting jig saw which is driven by a 25-hp. motor. The timber, after being marked off by the mold-loft's man with a race knife, is handed to the saw

from the far end of the shed. After it has been sawed to shape it is run along the rollers *C* on the runway to the left and the scrap ends are cut off with the large swing saw *D*.

In Fig. 14 is shown the operating end of the tilting jig saw. The saw *A* is hung in the rotatable circular frame *B* which is held by the posts and gibs *C*. At one side there is a graduated arc *D*, which is also secured to the post. On the periphery of the circle *B*, but not visible in the photograph, is a worm-toothed segment.

The handwheel *E* operates the worm that engages this worm segment and causes the circle to turn about its center. The saw *A* is connected to a pitman-operated guide. The lower end of the pitman *F* is provided *K* under the roller as shown. One end of the handspike bears heavily on the work *I* while the other end rests on the rear of the table *L*. At *M* are two feed rollers automatically operated by the machine. These have teeth that engage the bottom of the timber *I* and feed it at the correct speed through the saw. Many of the pieces that are sawed to shape by this machine have beveled sides, the angularity of which changes from one part to another. All the angles and the changes are marked on the timber by the mold-loft's man, and the operator of the machine can easily follow the instructions on the timber while it is in motion through the tilting jig saw.

This same class of work can also be done on a tilting

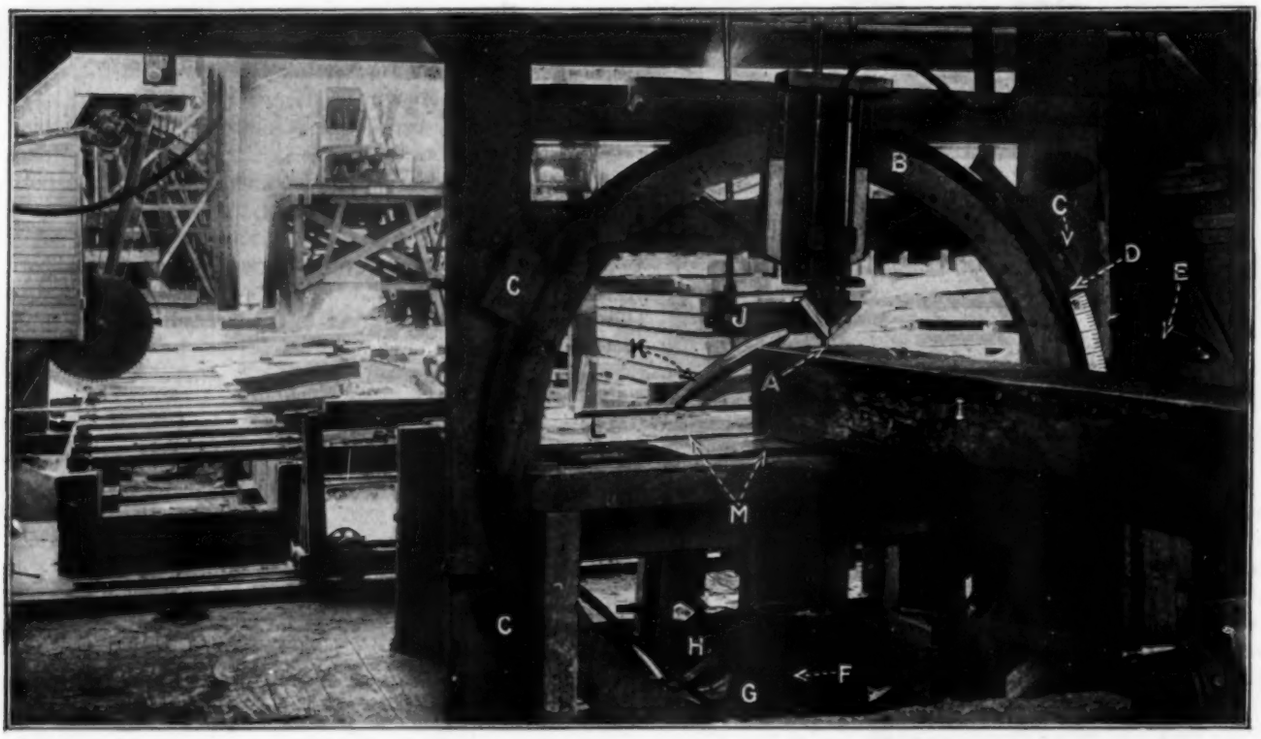


FIG. 14. OPERATING END OF THE TILTING JIG SAW

with a bearing which engages a crankpin on the disk *G*. On the same shaft with *G* is a pulley *H* which carries the belt that operates the saw. This belt, before it reaches the pulley *H*, passes over an idler and after it passes the pulley *H* passes over another idler. These idlers are both so located that the rotation of the circle *B* does not interfere with the transmission of power through the belt to the pulley *H*, disk *G* and pitman *F* to the saw itself.

The saw is about 3 in. wide and about ¼ in. thick, with coarsely pitched teeth. There is considerable set to the teeth so that the saw will not bind readily on arcs of moderately small diameter. A nozzle above connects with the air service of the plant and blows the sawdust away so that the operator can see the mark he is to follow. The work *I* shown in the illustration is a piece of hard yellow pine 12 in. square. The saw cut has just started on it. At *J* is a pressure roller to prevent the work lifting on the upward, or noncutting, stroke of the saw. When starting the cut and before the work has reached the pressure roller *J* one of the operators inserts a "handspike," or wooden lever, band-saw, but this machine is in such common use in pattern shops that it will be familiar to readers.

The men who build frames are called framers, and I am told that men who have never seen a ship have become expert framers at this yard in a couple of weeks.

The order in which the frames are set up is determined by local practice, but of course at a time like this the ability to obtain material is also a determining factor. Framing may start at the middle of the ship and proceed toward both ends or it may begin at either or both ends, as in this case, and work toward the middle. Less experience is perhaps necessary for erection of the midship frames, and if all the material is available the less skilled framers can be put at this work while the more highly skilled men are at work on the forward and after frames. The midship frames are all alike, so when a man has set one of them he merely has to repeat the same operation over again. The end frames are, however, all different, as the ship tapers toward the bow and stern. For this reason the setting of these frames is not a repetition job and consequently calls for a higher degree of skill.

The framing floor is usually a temporary platform built over and across the keel. There should be a crane or derrick to lift the frames into place after they have been assembled. In Figs. 7 and 9 the framing floor is shown. At this particular floor two derricks are available, each lifting the frame by slings secured to the upper part, as shown in Fig 9. In some yards no cranes are availble. Where this is the case the first frame shown at *D* in Figs. 11 and 12 is raised to position by means of tackles secured to temporary poles erected in the proper position and provided with guys to keep them there. After the first frame is in position the rest can be raised by means of tackles secured to the first frame.

The lower part of the frame is called the floor, and in the frames for these ships it is 30 in. deep. The wood from which the frames are made is 12 in. thick, and as there are two thicknesses the entire frame is 24 in. wide or thick. At the upper part, where the deck of the

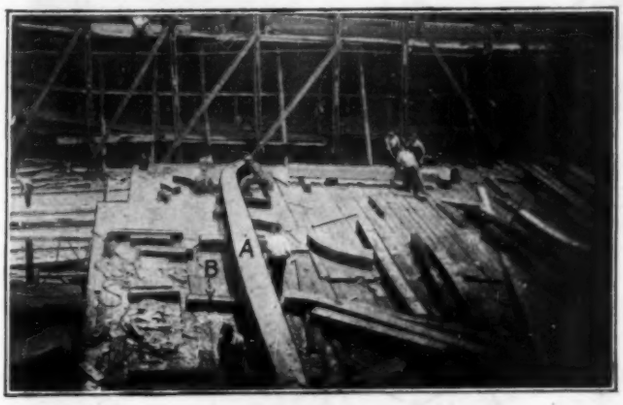


FIG. 15. THE START OF A SQUARE FRAME

ship is, the frames taper off to 10 in. in depth, but their width is still 24 in. The finished midship frames are about 45 ft. wide by 30 ft. deep. The timbers for the floor of the frame are first placed, as shown at *A* in Fig. 15, lying on top of each other with their center lines corresponding. Beneath them are short blocks of wood *B* to permit the clamping chains to be passed around them and also to permit the use of wedges when necessary to level the pieces of timber composing the frame.

When these floor timbers are placed, holes are bored with the air drill and treenails are driven to hold them as placed. When driving the treenails are prevented from splitting by slipping a steel cap over the end. These caps are often made of a piece of square steel of sufficient diameter and about 6 in. long, into the end of which a hole has been drilled that is an easy fit for the end of the treenail. Treenails that jam in the cap are removed from it by burning them out after the treenail has been sawed off below the face of the cap. Treenails that break before they are driven to the required depth are sawed off flush with the face of the timber and then drifted out with an iron bar small enough to pass readily through the hole bored for the treenail.

Beveled frames should always be assembled with their floors directed toward the part of the ship that they are to occupy. That is to say the beveled frames for the stern should have their floors toward the stern and those for the bow toward the bow. This, when the frame is hoisted into a vertical position, brings the narrowest edge of the frame toward the stern or bow, as the case may be, and avoids the necessity of turning such a cumbersome piece around, which would have to be done if the frame were assembled the other way around. The tools used by the framers for handling the "futtocks," or component parts of the frames, into place are crowbars and cant hooks. Great care is taken to have all the joints between futtocks, both side and end joints, as close as possible.

After assembly two braces *E*, Figs. 11 and 12, are lag-screwed from side to side of the frame to prevent it collapsing when it is raised. These braces are called cross-spalls. One of them is secured at about the height of the top of the deck beams and the other about the height of the top of the 'tween-deck beams. Before raising, chains are placed and wedged around each joint to prevent straining at the joint. Chocks *F*, Fig. 12, for the shores *H* which are to hold the frame are lag-screwed in place. The chocks are recessed to form a seat for the end of the shore to prevent its slipping. Ropes *F*, Fig. 11, are secured about the heads on each side of the first frame *D*, with length enough so that there is a part leading well ahead and well astern on both sides to act as guys to steady the frame and set it perpendicular. Usually wire rope is used for this purpose and turnbuckles are provided to facilitate the setting of the frame.

THE FRAMES

The number of frames in these ships is 88; they are 2 ft. wide and spaced 3 ft. center to center along the keel, thus giving a space of but 1 ft. between frames. The numbering of the frames is from the stern toward the bow; that is to say frame No. 1 is at the stern and frame 88 at the bow. Each frame, from frame 7 to frame 32, increases in size over the one preceding it. The same is true of the bow frames from frame 83 to frame 60. As the frames approach the uniform frames amidships the difference from one frame to the next becomes less and less. Forward and aft and amidships are raised portions of the ship, termed respectively the forecastle head, the poopdeck and the bridge. Where these structures are, the frames are carried up to support them. The frames at other parts are therefore shorter than at these points. At these lower portions the frames are carried up above the deck by one-half of their breadth only. This is shown at *G*, Fig. 9. These pieces are called "timber heads," and they support the bulwarks. In other words, they act as fenceposts for the solid railing of the ship at these parts. While the frames are being set up the scaffolding around the ship is also in course of erection, so that the workmen can lag-screw wooden supporting or staying members, called ribbands, to the frames. These ribbands are to correct slight unevennesses of the frames so that they will present an even surface or series of surfaces to which the planking can be secured.

The cant frames at the forward part are secured to the dead wood, previously referred to, and not to the keel as are the midship frames. The same construction is also true of the half frames aft.

At the extreme front end, or bow, of the ship is a vertical piece of wood of large dimensions called the stem, or sometimes the stempost, as opposed to the

sternpost. The stem as shown at *B*, Fig. 11, is recessed to form a seat for the ends of the planking or outside covering of the ship. Another piece of heavy timber is bolted behind the stem to reinforce and strengthen it and to give greater surface for supporting and fastening the ends of the planking. On the inside of the stem and at the base is a heavy knee *G*. These are usually of hackmatack, a tree which where the root branches out forms a natural crook that is very strong. This knee is secured to the stem and also to the keel.

The setting of the cant frames is facilitated by the use of a species of templet called harpens. These are laid out in the mold loft, sawed out and secured to the stem and to the forward bevel frame. When in position they indicate the shape of the forward part of the ship. The cant frames are then put together and hoisted up into place inside and touching the harpens.

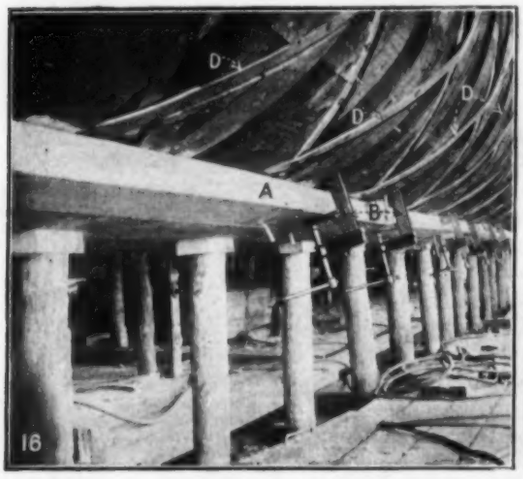


FIG. 16. APPLYING THE BILGE PLANKING

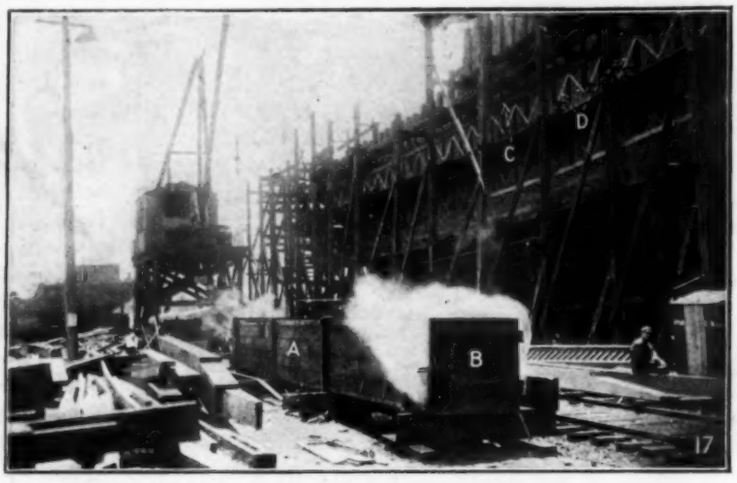


FIG. 17. THE STEAM BOX

Their lower ends come flat against the dead wood. Unlike the other frames the cant frames are not at right angles with the keel of the ship. They spread out fanwise so as to offer better support to the planking that has to stand the buffeting of the sea. This method of setting them also obviates the necessity of shaping their faces, against which the planking is secured, at such an acute angle as would be necessary were they set at right angles to the keel. The half frames which are secured to the dead wood at the stern are similar to the cant frames in that they are not made in a single piece reaching from side to side of the ship. They are also placed fanwise in the same manner as the cant frames.

Owing to the fact that the propeller shaft must pass through the sternpost, the sternpost at this point must be made strong enough to compensate for the removal of the wood where the shaft goes through. Where it is impossible to find wood large enough in one piece for the sternpost it is common practice to build it up from several pieces. The same practice also holds good for the dead wood at this point. Where such parts are built up it is the common practice to introduce a piece of soft white pine between the adjoining surfaces of the components.

The soft-wood pieces are termed stop waters because they swell and prevent leakage. Beyond the sternpost, leaving sufficient room for the propeller, is another post called the rudder post, and on this the rudder is hung. Both the sternpost and the rudder post are mortised into the keel. Besides this iron angles are provided to hold them securely in place.

The hand tools used by the ship's carpenter are the adze, shown in Fig. 6; the broad axe *H*, Fig. 10; pin maul; a few broad chisels *A*, Fig. 10, and a very broad, long-handled chisel called a slicer. These should form at least a part of his kit; the rest of the tools that he requires can be obtained from the yard toolroom.

The planking, or outside covering of the ship, is bolted on and also fastened with treenails. At the middle of the ship the planks *A*, Fig. 16, are nearly straight when they are secured to the frames. The slight amount of bending can therefore be easily done by means of the clamps shown at *B*. At the bow and stern, where they must be curved considerably, they will not in their natural state stand the excessive bending without splitting. When this is the case they are steamed in a steam box such as the one shown at *A*, Fig. 17. This is merely a rectangular wooden box large enough to accommodate the largest size of timbers it is intended to bend. Live steam at low pressure and very wet is admitted to the steam box after the timber has been placed in it and the door *B* closed. An hour or two in here will soften up the timber so that it will bend easily.

At the level of the deck and let into the frames is a band of steel *C* $\frac{3}{4}$ in. thick by 8 in. wide. This chord is held in the slot in the frames by through-bolts riveted on both ends. It is made up from 30-ft. lengths held together by butt joints with riveted straps. The straps are $\frac{3}{8}$ in. by 8 by 18 in. At intervals of 6 ft., or in the center of every alternate opening between the timbers, diagonally disposed steel strapping *D* is riveted to the chord. This strapping is $\frac{1}{2}$ by 4 in. It is let into the frames in exactly the same manner as the chord, and is not only bolted to the frames but where the strapping crosses the two parts are riveted together. The strapping is applied at an angle of 45 deg. to the chord in both directions and the two sets therefore cross each other at intervals of two frames and between the frames so that the insertion of the rivets is a simple matter. The strapping *D* can be seen more clearly in Fig. 16.

The Marching Equipment of a Soldier

By PAUL ALLEN MACKENZIE

THE development of the United States soldier's military carrying equipment, which is the result of more than thirty years' continuous study, occasioning steady improvement and the evolution of wonderful machinery, is interesting. All of this equipment is now made of heavy military webbing and duck woven in the shapes required instead of leather, and its manufacture is one of the most intricate in the textile field. The cartridge belt and other items of this equipment are made of cotton, which will stand moisture with little or no shrinkage and stretching. It is also the standard equipment of the British army. Half a century ago soldiers were served clumsy leather pouches, in which they carried their heavy-caliber cartridges, which were loaded singly. These pouches were not only weighty but decidedly uncomfortable to wear. The field equipment of the American infantryman is recognized by military authorities all over the world as being the finest that has yet been produced by any army. Conditions of trench warfare will probably effect many changes, but as a marching equipment it is unsurpassed. The illustration here shown of an American infantryman in full marching equipment illustrates the practicability of the outfit. There are 100 rounds of ammunition in the cartridge belt, which is supported by suspenders over the shoulder and adjustable according to the size of the wearer. The belt is also adjustable in the back for waist measurement. There are five pockets on each side, each holding two clips of five rounds of 30-caliber ammunition. Between the pockets on the belt are eyelets to which can be attached any extra item of equipment that a soldier might require for the special work to which he might be detailed. The hangers for all items of equipment in the army are standard, so that they will fit the holes in the cartridge belt.

Soldier With Full Marching Equipment

The straps, belts, pouches and practically all parts of a soldier's equipment which were formerly made of leather are now manufactured of military webbing and duck woven into the shapes required. This not only saves leather for other necessary purposes, but the woven equipment is better in every way than the former leather parts.

The bayonet is carried on the side of the haversack. This is much better than the old way of attaching it to the waist belt, which spoiled the balance of the belt, dragging it down on the side and being a continual source of annoyance by hitting against the soldier's thigh on the march as well as sometimes causing injury, when advancing under fire the infantryman had to throw himself on the ground between rushes. The pack carrier is attached to the haversack, and in it are carried the private personal articles, his blanket, poncho and extra wearing apparel. On the right hip attached to the belt is the canteen. High on the shoulder is the haversack, containing extra rations, and so made that it can be adjusted to the quantity of food to be carried and never presenting the slovenly appearance of a half-filled bag. Attached to it is the meat-can pouch, under which is fastened the intrenching shovel, the handle of which is strapped to the haversack by a coupling strap. The pack carrier is laced to the bottom of the haversack, so that on a forced march it can be easily discarded to lighten the load without stopping to unpack or throwing away the whole pack as was necessary when the old-fashioned knapsack was used. Hanging from the belt in the front and to the right side is the cotton-webbing pouch which contains the hermetically sealed emergency and first-aid packet. Almost every article of the soldier's equipment—bayonet scabbard, canteen cover, shovel carrier, pick carrier, hand-grenade carrier, first-aid packet, bolo scabbard, pistol belts, cartridge belts, field medical belts and other special articles of equipment—is made of webbing, or canvas, which takes the place of the more expensive but far less du-

rable leather which was previously used. The dispatch case and officers' Sam Brown belt are made of leather.

The web equipment is much superior to leather also because it is not affected by long rains or lengthy spells of torrid weather. It is equally serviceable and efficient in any temperature and it requires no dressing, as is the case with leather.

In the old days when soldiers were served with clumsy leather pouches they contrived leather belts with hand-sewed loops to hold the cartridges, thereby considerably facilitating their free movements; but the objection to this extemporized ammunition belt, or bandoleer, was that the loops would pull out, which involved the loss of ammunition.

Gen. Anson Mills of the United States Army, whose attention became attracted by the loop-belt idea, realized that if this form of extemporized ammunition belt could be woven from heavy web it would become a decided benefit to the fighting man and would be superior to leather.

However, ordinary canvas was too susceptible of shrinking and stretching, according to the variations of weather and climate; therefore he produced a belt woven from end to end in a single piece and fitted with loops to receive the cartridges, which were kept from falling out by the rims which fitted tightly to prevent them from slipping through.

Building the Loom

General Mills, in his autobiography, tells the story of how he took his first lesson in weaving from his mother, who did the weaving for the family in their pioneer home in southern Indiana, where he learned to "hand in" the threads of the warp. He retained an appreciation of the possibilities of the art, and when he hit upon the idea of a cartridge belt with woven loops he thought out what he believed to be a method of producing the loop as an integral part of the belt.

He proposed the idea to several loom builders, who rejected it as impractical, but he finally found in Paterson, N. J., a Scotchman who believed that the loop could be woven, and together they made a crude device for accomplishing it. It was necessary, however, to have a power loom if the idea was to be made practical, but for a long time Mills could find no one who would undertake to build such a machine. He finally reached George Crompton of Worcester, Mass., who encouraged him in the belief that the machine could be built. Being in ill health and about to retire from business Mr. Crompton suggested Charles W. Gilbert, a builder of carpet looms who agreed to build a loom for Mills. On its completion the thing stuck and halted and finally Mills obtained a furlough, went to Worcester, and with some of Gilbert's mechanics, he put the loom through.

It was a success, and from the first it wove the loop on the body of the belt as Mills had outlined it. The first loom was a small machine, but it did the work as good as the more recent machines of greater capacity, which are the outgrowth of Mills' original loom.

Tests with this belt have conclusively established its ammunition-carrying advantages, and in 1880 it was adopted as the regulation equipment of the United States Army and in its various improved forms has been the service equipment ever since.

As greater rapidity of fire was gained through the adoption of the magazine rifle it became necessary to increase the number of cartridges to be carried. This has been one of the factors in choosing a light-weight bullet that would need less powder behind it to obtain the requisite energy. This in turn meant lighter ammunition and as a result more of it could be carried.

In the Spanish-American war the American troops used the old single-shot Springfield rifle, the cartridge for which was about one-third heavier than the present 30-caliber 1903 rimless cartridge. As the caliber of the cartridge underwent reductions in weight through successive improvements in both rifle and ammunition it became practical to carry a greater amount of ammunition about the person of the soldier.

To meet this new development a woven belt with a double row of loops, one on top of the other, was invented, which increased the soldier's supply of ammunition from 40 to 50 rounds.

Effect of the Magazine Rifle

When the magazine rifle superseded the single-shot rifle, the type of woven belts used was found to be no longer serviceable, as the ammunition was carried in clips. The army, however, attacked the new problem and began experimenting with the woven pocket forming part of the belt. This presented many difficulties. If the pocket were merely sewed to the belt there was the ever-present risk of the stitching giving way, in which event the contents would be lost. At last they succeeded in weaving the pocket and the belt in a single piece.

The idea was presented to the British army on the outbreak of the Boer war. That army, however, had been firmly wedded to the leather equipment, and as the web belts that were made in England were often poorly woven and were not satisfactory the invention failed to obtain the recognition which it deserved. Ultimately the value of the web equipment was recognized and a British company was established in 1906, the firm operating closely with the patentees to one common end.

The very much larger ammunition-carrying capacity of the web belt over the leather-cartridge equipment, together with the fire control of the British army, has enabled it to perform a more vital rôle in beating off the enemy than is realized. This was demonstrated in the open fighting in the early days of the war, particularly on the retreat from Mons. The large number of cartridges carried by the British soldier, coupled with the cheap cotton supplementary bandoleer system of renewing his supply of ammunition, served to counterbalance the enormous numerical superiority of the German troops.

The German leather equipment provides a total of 120 cartridges. At his belt in front are two pouches, each containing 45 rounds, while a reserve of 30 rounds is carried in his knapsack. This last feature is very weak, inasmuch as valuable time is lost in securing this reserve at a critical moment.

The British soldier, on the other hand, carries 150 rounds in two sets of five 15-round carriers disposed in two tiers on either side just above his belt, and a further 100 rounds is in the emergency bandoleer, which is likewise convenient to hand, being thrown across his chest.

Consequently, he has more than a two-to-one ad-

vantage over his adversary, and he has never hesitated to drive this advantage home. The German rifle has not anything like as rapid fire as either the British or American arm, which is another disadvantage.

The American infantryman's belt has ten pockets holding two clips of five cartridges each, or 100 rounds of ammunition, and in addition, when going into action, he carries two bandoleers containing 60 cartridges each, or a total of 220 rounds. If necessary three bandoleers can be carried.

A Salvaged Small-Shop Boring Mill

BY J. V. HUNTER

The small jobbing shop sometimes feels the need of some type of machine tool which neither the amount of work in hand nor the finances warrant the outlay for its purchase. Various interesting devices are

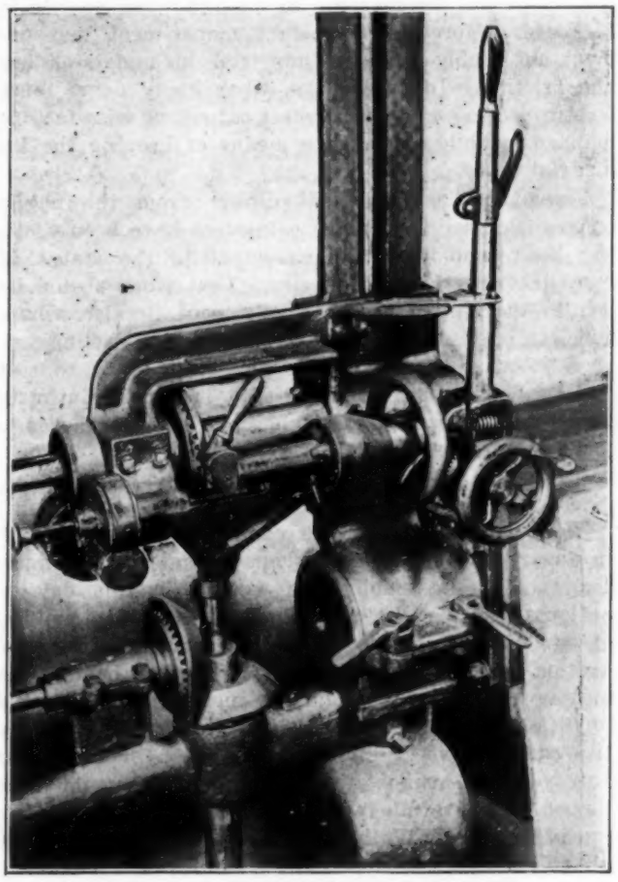


FIG. 1. A HOME-MADE BORING MILL

worked out from time to time by such shops in an endeavor to make some sort of rigging that will temporarily solve the difficulties.

However, it has remained for P. J. Metz, in his Chicago machine shop, to bring out a new idea in the line of a home-made horizontal boring mill. The table and head for this machine are illustrated in Fig. 1, and the latter will be recognized by many of our readers as belonging to one of the older type of radial drilling machines. This arm was obtained from the scrap yard of a dealer in second-hand machinery.

The table necessitated a pattern and casting which was planed up in the shop and is provided with legs as will be noted. The method of attachment of the radial arm can be understood from the illustration, Fig. 2, which shows how it is bolted to a lug on the bottom of the table by means of a dummy post, which passes through the hole which originally fitted over the column

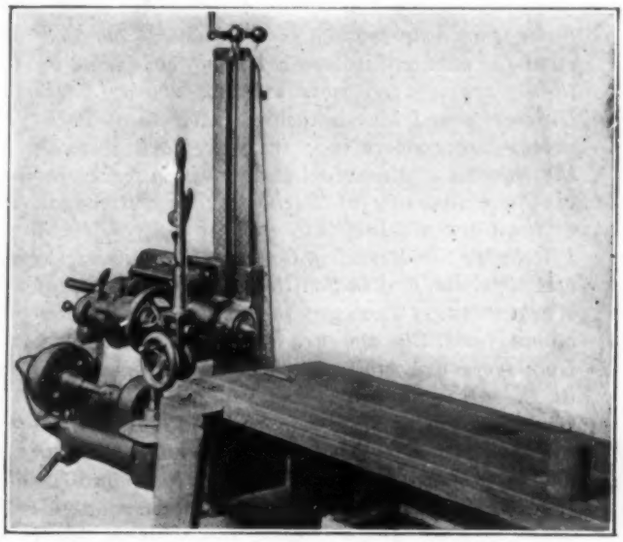


FIG. 2. DETAILS OF THE HEAD

of the drilling machine. Naturally this home-made boring mill lacks some of the advantages of the more modern machines, but it has greatly facilitated the handling of a large amount of work and has the additional advantage of not requiring a large investment.

$300,000 for Engineering Research

Ambrose Swasey of Cleveland, Ohio, has just given the Engineering Foundation an additional $100,000 as an endowment for engineering research. In 1915 he gave $200,000 for the same purpose, so that his entire gifts are now $300,000. Mr. Swasey's original gift made possible the establishment of Engineering Foundation by the United Engineering Society, representing the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

Mr. Swasey is a past president of the American Society of Mechanical Engineers and is well known as a designer and builder of large telescopes, other optical instruments and fine machine tools. His donations have been inspired by his conviction of the necessity for research in engineering sciences in connection with the war and in keeping the United States in the forefront of the nations in industrial development in the new peace era. The latest gift is an expression of Mr. Swasey's appreciation of the war service that the United Engineering Society and the Engineering Foundation have rendered to the country, but, generous as they are, other endowment is needed in order that the big work that the Engineering Foundation has in hand may be put forward without delay for the welfare of the country.

The gift was announced Monday, Oct. 7, at a joint meeting of the trustees of the United Engineering Society with the Engineering Foundation Board in the Engineering Societies Building, 29 West 39th Street.

Who and What Is the Employment Manager?

By C. T. CLAYTON
Director of Training and Dilution Service, United States Department of Labor

Emergency war courses in employment management for men and women are being conducted by the Government in Boston, where Harvard, Boston University and Massachusetts Institute of Technology are coöperating; in New York through the Bureau of Municipal Research; in Rochester at the University of Rochester; in Pittsburgh at the Carnegie Institute and the University of Pittsburgh; in Berkeley, Calif., at the University of California, and in Seattle at the University of Washington. Courses at the universities of Cincinnati and Chicago are now being arranged. Employers are invited to name men or women in their employ for these courses, which run from six weeks to two months. There are no tuition fees. Employers or individual applicants will be furnished complete information regarding the courses and entrance requirements by addressing Capt. Boyd Fisher, Employment Management Division, War Industries Board, 717 Thirteenth St. NW., Washington, D. C.

AS MODERN business organization increases in complexity further division of responsibility and more closely defined delegation of authority must be extended or the management will become chaotic. It is more and more being recognized that a most important function in a well-organized industrial establishment is the hitherto neglected responsibility of selecting, placing, and advancing workers. This is what we mean by the term "employment management."

Employment management goes further, however, than merely concerning itself with such selection, placement and promotion. It investigates the character, experience and capacity of the applicant. It investigates for placement, and does not limit its investigation to the applicant. It sounds possibilities of openings for replacement, and it employs every means to secure the comfort and safety of the worker and thus assists his advancement by giving him a quiet mind and an assured future.

The employment manager is really the conscience of modern industry in practical action. In the old days when employers had but few workers and themselves worked side by side with them every worker was individually known; his idiosyncrasies were understood; his ambitions were appreciated because they were like to the boss's ambitions. But now when workers numbered by the thousands are employed by a collective boss, who is a mere list of stockholders living perhaps thousands of miles from the works and knowing the workers only as items of profit or loss on a ledger, some substitute for the old personal touch must be found or industry will become, first, congeries of unrelated items in reports, and, finally, mere anarchy. If modern industry is to be well knit, is to understand and accomplish its real purposes, it must cultivate its conscience—the employment manager.

The usual method of business organization unfortunately has so far failed to take in this function as a distinct part of factory control. The foreman should not be charged with the responsibility of selecting his gang. Good management does not require that he do so. Factory after factory has demonstrated that if the foreman's power includes that of sending back an unsatisfactory worker to the employment manager for removal and replacement that is sufficient for purposes of discipline. But when it is considered that the cost of securing and training each worker ranges from $10 to $200 and averages probably more than $60 each a stupendous leak in the business that still clings to the antiquated foremanship hiring-and-firing method is disclosed. Moreover competent employment management noticeably reduces industrial misunderstanding and friction. In these days, when every nerve must be strained to secure the highest output, no wise factory manager will ignore such a means of keeping the industrial peace.

Employment management differs from the public employment service. Some employers have been limiting their employment management to the status of mere labor-recruiting agencies. That work should be left to the United States Employment Service, whose function is to find the labor and sift it in a preliminary way, offering those workers who seem likely to suit to the employment manager for his more intimate knowledge of the factory's needs his more thorough methods of selection.

The Employment Agency

The employment manager cannot be dispensed with in favor of the public employment agency any more than the public employment agency in this day of national need can be evaded. At least twelve million of our working people are today engaged in the production and distribution of war supplies behind our military forces. Six million or more will be required to fill the toll of increased demand brought about by the call of two millions to the colors before next July. Every available new source of labor must be tapped and carefully selected and trained before placing in industry. While the Government will give every possible assistance, advice and guidance in this tremendous operation it is the plainest common sense to counsel that every industrial concern immediately secure the best possible employment manager and place upon him the authority and responsibility of a direct delegate from the highest command in the establishment. With any less authority the employment manager is almost sure to fail.

The provision of an adequate number of competent persons for employment management is one of the serious elements. Forty thousand firms in this country are now engaged in war production, and many more are daily undertaking the work as less essential industries change over. The only source of trained supply so far is the work being done by the Employment Management Section of the War Industries Board, the

successor of the work begun in the Council of National Defense. This section is fostering the training of men and women previously experienced in some phase of industrial work by intensive courses upon employment management in classes at various universities. Such men and women must have had at least three years' experience in industrial methods and personal knowledge of shop problems. In most cases they are delegates from war-supply factories.

The training and dilution service will be much more effective where it is able to deal through a competent employment manager with factories facing the great problem of expansion in labor supply. This service urges every factory to put in a thoroughgoing employment department and suggests that all factories not so organized select some one from their organization having the groundwork of experience and the right mental horizon and send him or her to the training course.

The Employment Manager as a Factor in Industrial Relationship

By EDWARD D. JONES
Director of Course Materials, Employment Management Division, War Industries Board

THE general executive is a correlator; he is a balancer of claim against claim. His business is to define the general aim and to harmonize all lesser or intermediate achievements with it. To do this work well he must be supplemented by specialists who do not correlate or determine general aims or policies, but who concentrate upon some special phase, and upon demand furnish to him standards and reliable standardized agencies. The line executive in war determines where a battery shall go and what it shall do, but he depends upon staff men to select a reliable artillery horse, to design convenient gun carriages and to prepare service tables for sighting guns.

In industry the function of staff departments is already seen clearly with reference to mechanical equipments. The general executive desires a works, but he depends upon the architect to design building members that will sustain the probable stresses. He desires a product, but he organizes a designing and drafting department to control the dimensions of parts. This principle of staff service is now being carried over into the field of human administration. General executives demand well-chosen men, men physically examined and pronounced safe for the work they are to do, men who are properly paid and men who are so handled that they become permanent, contented and loyal coöperators in the general plans of the enterprise. Of all standardized agencies which a service department can put at the disposal of a general executive the supreme one is a first-class man.

An Extension of the Division of Labor to Foremanizing

The distinction just drawn between line and staff is a case of the application of the principle of the division of labor to administration. This principle is being applied just now rather vigorously at a lower level in the hierarchy of industrial administration. It was one of the merits of scientific management that it called attention to the absurdly wide range of functions that the average foreman was endeavoring to perform. This officer, until a short while ago, was attempting to hire men, to set their wages and discharge them, to find work for men and machines from hour to hour, to recommend equipment for the shop and keep the equipment in repair, to give an offhand opinion as to when future work would be completed and what it would cost, to maintain a stock of raw materials, to preserve discipline, and to furnish the office with such records as it required.

It is needless to say that the degree of efficiency attained with such supervision was low. Machinery was operated at a low percentage of its possibility; time was lost in hunting tools, in waste of stock, in delayed deliveries, in unreliable quality and in inefficient, discontented workmen.

The remedy is functionalization. This means that groups of related functions should be put in the charge of service departments, such as the stock room, the planning room, the toolroom, the designing department, the engineer in charge of repairs and the estimates department. In conformity with this idea there has come into existence in thousands of businesses a department (whether administratively distinct or called by any name suggesting it or not) in charge of the supervision of a considerable portion of the relations between employer and employee.

The Foreman's New Duties

In this way the foreman is relieved. He no longer is a "bouncer." He no longer sells jobs, or practices nepotism, or holds his pets in soft jobs. He has not the easy device of covering his own incompetence by firing a man, but must suggest a transfer which may show his employee able to give satisfaction in another shop where the foremanship is different. He gets a more even and dependable run of workmen from the employment department than he could provide for himself. And he is free from other distractions to become the teacher of the shop.

Vocational guidance is closely allied to vocational education. It has made much progress in connection with the work of the public schools, supplementing parental advice, which is no longer adequate in these days of innumerable trades. It offers to the pupil a new reason for taking interest in his school work, namely, his interest in his own future career.

Vocational guidance has shown us the necessity of analyzing industrial tasks, to find out of what they consist, in what their peculiar difficulties lie and what qualities they demand of the worker. It has shown the need also of studying the mentality of the youth and of endeavoring to understand his temperament, so that work may be found for him which accords with

his talents, which possesses interest for him and which has power to evoke his enthusiasm.

This experience of the schools in the guidance of youth has caused us suddenly to realize that for most communities the only vocational counselor yet available is the man who does the hiring in the factory. And so hiring takes on a new significance. It is no longer giving out jobs; it is, or ought to be, vocational guidance. We demand for this important function skill and specialized experience and a high ideal of responsibility to the person employed.

The Evolution of Wage Systems

The conviction is general among employers that the setting of a wage rate is perhaps the most vital matter in the relation of employer to employee. The employer needs to have such investigations made as will reveal the current market rates for different types of labor power. He needs an expert to supervise patiently the prolonged process of forming a wage scale, in which each job in the factory will find its proper place.

It is coming to be realized that wages can never be made wholly satisfactory until greater definiteness is attained in measuring the basic factors involved in it, namely, the worker's talent, the quality and quantity of effort required by the task, and the working conditions. Where low rates of pay are concerned it is essential to obtain the local cost of living by first-hand inquiries. Where excess performance is required it becomes a problem for the expert to say what excess above standard wages is required.

The ideal wage system is that of the man in business for himself. For such a man reward rises and falls in perfect accord with his performance. The endeavor of executives to approximate this wage in the complexities of modern business has led to the devising of many kinds of production bonuses. Where these bonuses are sufficiently localized upon an individual shop and pertain to a sufficiently definite and measurable aspect of performance, and where they are properly founded upon an hourly wage rate and a standard of performance, they have given satisfaction. To plan such bonuses in strict accord with the conditions of the individual business the employer needs the service of a competent department.

The United States Employment Service has undertaken to supply war plants with labor. Clearly it is incumbent upon the manufacturer to make the best use of that supply when it has been made available for him.

The question that he asks himself is "How?" And under present conditions there is but one answer, "Improved working conditions for his employees." He must take the best possible care of his labor if he would keep it, and his production and his credit with the United States Employment Service suffer if he does not. With this problem before him in general terms the employer turns to his employment manager from whom he has the right to expect advice as to definite methods to be pursued and suggestions as to the specific application of well-established principles to the particular problems of his plant.

The Government has seen to it that if the employment manager has had the advantage of instruction at one of the war-emergency courses the harassed executive may have his problem solved. These courses in employment management are offered to the representatives of manufacturers without charge and at the express request and under the supervision of the Industrial Service Sections of the several departments at Washington, including the Emergency Fleet Corporation, the Ordnance Department, the Quartermaster's Department and the Departments of Labor and of the Navy.

The organization and direction of the course has been undertaken by the Employment Management Division of the War Industries Board. This division has placed the direction of course materials in the hands of the foremost authorities on employment management in the country and has arranged for the services of large numbers of special lecturers, some of whom are the direct representatives of the coöperating Government departments. It has provided for a first-hand study of typical employment departments in plants where a large variety of difficult problems has been solved by the application of principles explained in text and classroom, and has seen to it that ample time for practical discussions and the interchange of ideas shall be allowed the students from day to day.

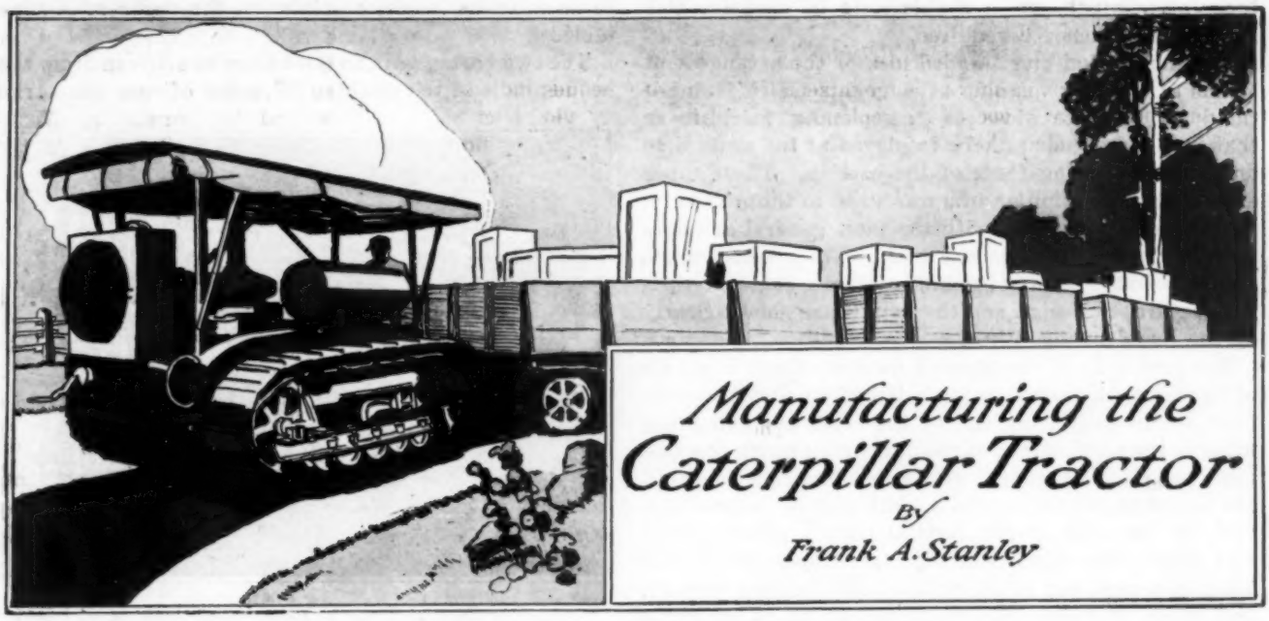
The mature employment manager, coming to the course with a solid background of industrial experience and with the problems of his own plant constantly in mind, learns from his contacts there many new devices, finds his point of view broadening and discovers new avenues of approach. At the conclusion of the course he returns to his own plant strengthened by an accumulation of expert advice which he could have secured from no other source and stimulated by a vision of new ways in which he can prove himself of value to employer and to employee. He knows not only what ought to be done but how to do it.

The Relation of Screw-Thread Angles to Other Functions

By Harry E. Harris

I have read with great interest "The Relation of Screw-Thread Angles to Other Functions" on page 571 of the *American Machinist*, by H. J. Bingham Powell, and his contention that the U. S. Standard threads in a great many cases become accidentally rounded in the course of manufacture from various contingent causes is undoubtedly correct.

As an engineer experienced in the production of not only threaded parts, but taps, dies, threading tools, thread gages and master form tools extensively on both the Whitworth and the U. S. Standard, I would state unreservedly that it is much more expensive to produce the tools for making Whitworth threads than for the simple straight-lined U. S. Standard or International form of threads, particularly in close precision work. Therefore if the threads will become rounded at the top and bottom, due to unavoidable contingent causes, I would suggest that the expense in making threading tools, taps, dies and thread gages for Whitworth threads be eliminated by changing the present Whitworth standard to have a flat top and bottom, thus saving a great deal of expense on the tools and still getting the Whitworth form by natural inherent causes. It would seem that this would be more advisable than to consider the rounding of a standard International thread.



Manufacturing the Caterpillar Tractor

By Frank A. Stanley

II. Operations on Crankcases

Some operations in milling, planing, boring and drilling important castings used on the motors of the "Caterpillar" tractor are herein illustrated, the description including the construction of a duplex boring fixture, a taper-planing attachment and other features of interest.

A FEW of the interesting operations and tools employed in machining crank and transmission cases of motors for "Caterpillar" tractors at the plant of the Holt Manufacturing Co., Stockton, Calif., are shown in the illustrations in this article. The crankcases shown in Fig. 6 in place on the horizontal boring machine for the milling of the sides are a little over 3 ft. long by 20 in. high over all. Their front and rear sides are sloped at an angle to the vertical of a few degrees, the angle being different for the two sides, as indicated by the positions of the two castings on the table of the boring machine. The appearance of the top of the case is represented by Fig. 7. The milling of the side faces, as in Fig. 6, is accomplished by means of a large, inserted-tooth face cutter which is carried upon the end of the boring-machine spindle and which is of sufficient size to sweep over the entire height of the surface to be machined at one pass of the work across the mill.

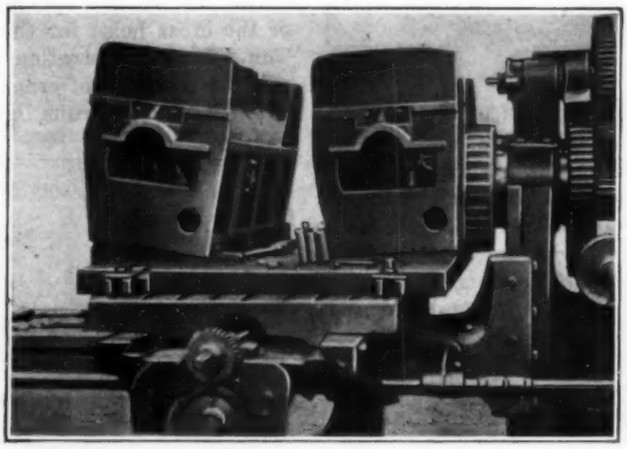


FIG. 6. MILLING THE SIDES OF CRANKCASES ON THE HORIZONTAL BORING MACHINE

The crankcase casting is supported bottom side up upon taper parallels which are secured to a special plate mounted on the regular table of the machine, and, as will be seen, there are two sets of these taper parallels of different slope placed at opposite sides of the auxiliary table. The pair of parallels at the right-hand side of the table, as viewed from the rear of the machine, give the crankcase casting a slight tilt inward to provide for the slightly sloping face on this side of the work, while the other set of parallels at the left is of decidedly steeper taper to give a correspondingly greater angle to the face to be milled.

Two castings are placed, as shown, on the two sets of taper parallels and there secured with their inner edges resting against suitable stop surfaces at the ends of the supports. The table feed is thrown in to feed the one casting past the big facing cutter, and after this has taken its cut clear across the work the entire auxiliary table is swung about on its central pivot to bring the other crankcase into position for facing. The castings are then transposed on the two sets of supports and the opposite faces of each finished in the manner described for the first face. The crankcases are machined on the ends by placing in long rows on the table of a planing machine and with two heads in operation on opposite ends of the cases. There is nothing unusual in the method of setting up and securing the work on the planing machine, so that this operation requires no description here.

An operation shown in Fig. 8 may well be described a little more fully. This is the taper planing of the side faces, for both the planing machine and the boring machine with the face mill referred to are used for surfacing these castings which are put through in very large lots, the planing machine being fitted with special

taper attachments which enable it to be used for this sloping cut whenever required.

The illustration gives a good idea of the arrangement of one of the taper-planing attachments which is duplicated on opposite sides of the planing machine so that both side heads may be employed at the same time on the two slanting faces of the casting. These taper attachments are similar in appearance to those used on lathes and are provided with the same general arrangement for giving the desired angle. The method of attachment to the planing machine combines some interesting features of design and the details are shown clearly by the line drawing, Fig. 9.

For each side of the planing machine there is a pair of brackets, *A* and *B*, being adapted to direct attachment to the projecting end of the cross-rail and being fitted to the vertical face of the upright on which the side head travels. Both upper and lower brackets *A* and *B* are planed out in the face to a width of 4 in. to provide a seat for the ends of the vertical bar *C*, which carries on a pivot at the middle the adjustable taper bar *D*. The latter is a steel bar 2¾ in. wide by 30¼ in. long over all, and along its under side a channel 1¼ in. is machined to form a guide for controlling the angular travel of the side-head tool.

The bar *C*, which is fixed by its brackets in vertical

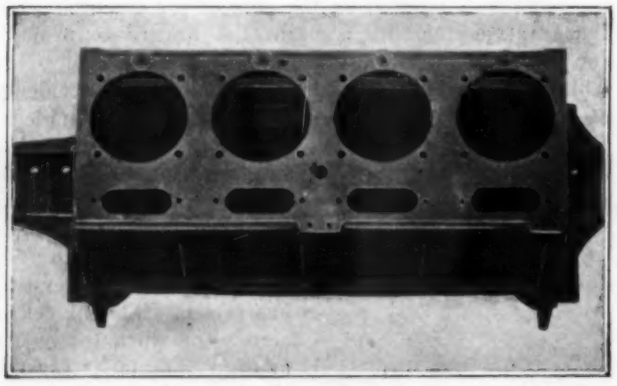


FIG. 7. TOP VIEW OF CRANKCASE

position, is formed with curved slots at the top and bottom, which are struck from the pivotal center of the taper bar so that when the bar is adjusted to the necessary angle of slope the clamp bolts at the ends will travel in the curved slots and form a means of securing the taper bar against movement under the action of the planing-machine head and tool. These clamp bolts are seen at *E* and the pivotal stud for the taper bar is shown at *F*.

With the regular side-head feed disconnected and the tool slide connected with the member traveling in the guide slot of the taper bar the tool travels along the same angular path to which the taper bar is set.

Boring Bearing Seats

The boring of the bearing seats in the crankcases is accomplished on horizontal machines with the aid of duplex attachments, one of which is illustrated in Fig. 10. This type of fixture is built up of two supporting brackets, as indicated, in which the boring bars are mounted at the right center distances, the brackets or housings being secured near the ends of the boring machine bed, with the crankcase to be bored strapped to an auxiliary table, or plate, on the regular machine table.

The two boring bars in the fixture are driven from the head spindle of the machine by means of spur gears, the

FIG. 8. TAPER-PLANING ATTACHMENT FOR SIDE HEADS

middle gear of the three being driven by a short shaft mounted in the machine spindle. This arrangement is best shown by Fig. 11.

The driving gears for the bars are all provided with long bearings running in the housings so that their center distances are always fixed, and the bars themselves are driven by feathers in the gears fitting the splined bars.

The boring bars are adapted also to carry shell reamers, and after the various cutters have been fed through the walls of the casting the reamers are fed through to size the holes. Two of the reamers are seen in operation at *A* and *B*, Fig. 12. In this view the gear guards have been removed, giving a better idea of the method of journaling the gear sleeves in the housings of the fixture and also showing the positions of some of the cross holes for the boring cutters and reamers. The different illustrations referred to show further the relative positions of crankshaft and camshaft bearings.

The crankshaft runs in special babbitt-metal bearings

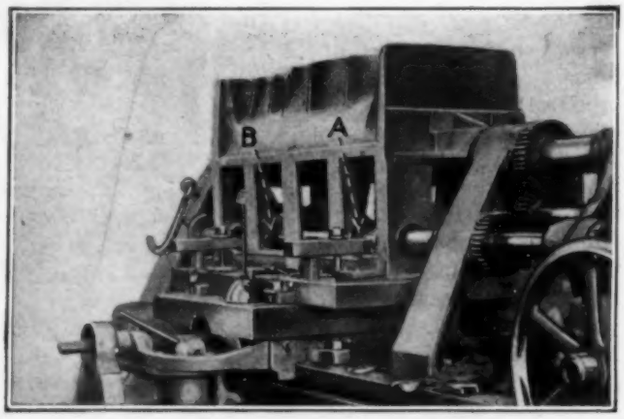


FIG. 12. SHOWING GEARING AND REAMERS

made up of boxes lined with this material and fitted into the seats bored out in the crankcase. The camshaft bearings are bushed with phosphor bronze.

The method of boring the boxes for the crankshaft

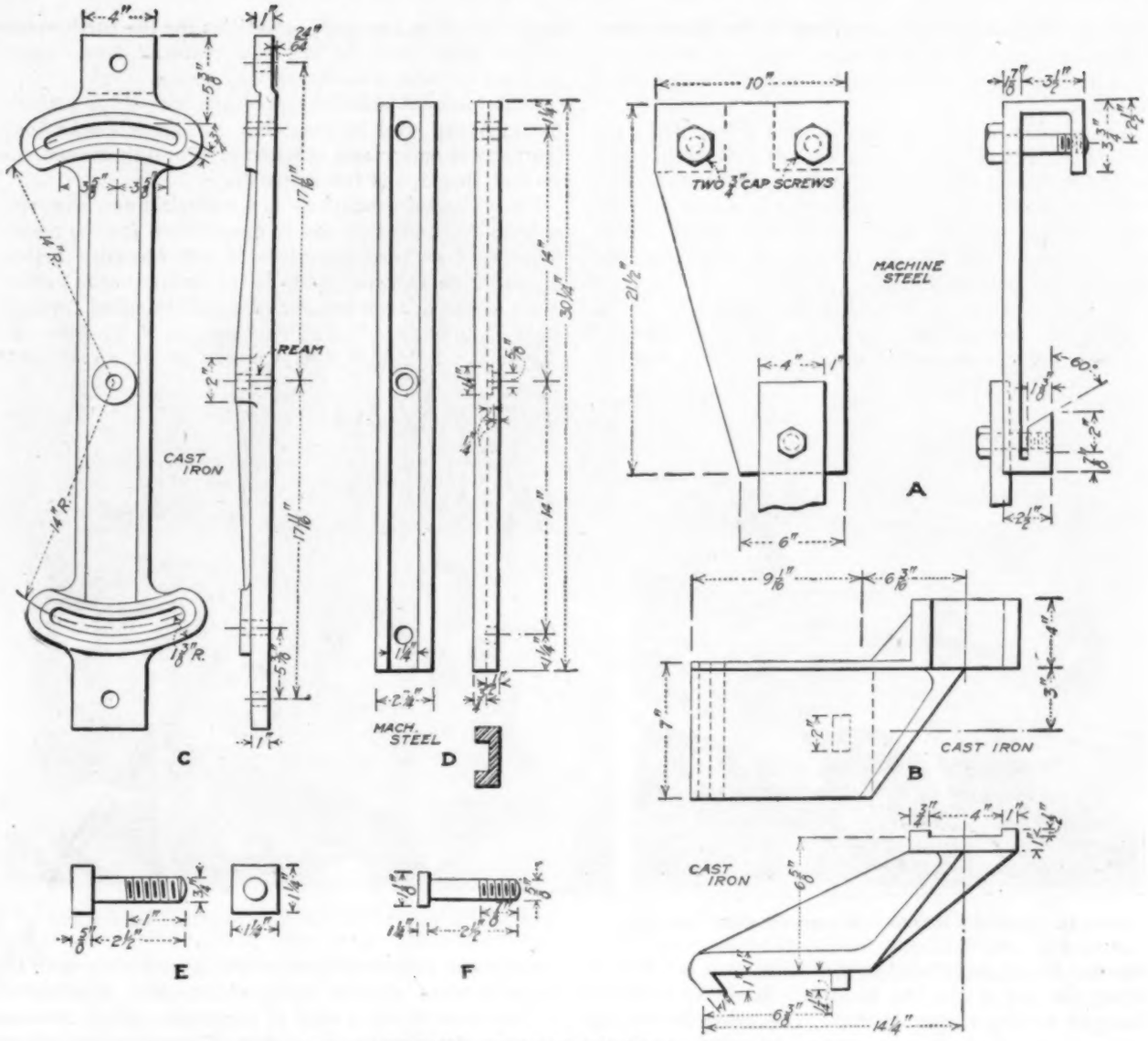


FIG. 9. DETAILS OF TAPER-PLANING ATTACHMENT

after lining with special babbitt mixture is shown in Fig. 13. This shows the half box and cap arrangement with the box proper turned to fit the housing in the crankcase, a complete bearing (lower half and cap) being seen on the carriage of the boring machine and another in the holding fixture with the boring bar in operation.

The fixture on the carriage consists of a half-open bracket bored in alignment with the head and foot stocks of the machine and to the diameter of the exterior of

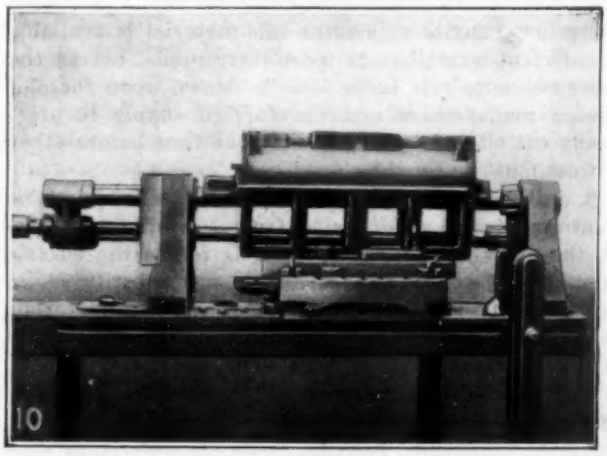


FIG. 10. BORING TWO SETS OF HOLES AT ONCE

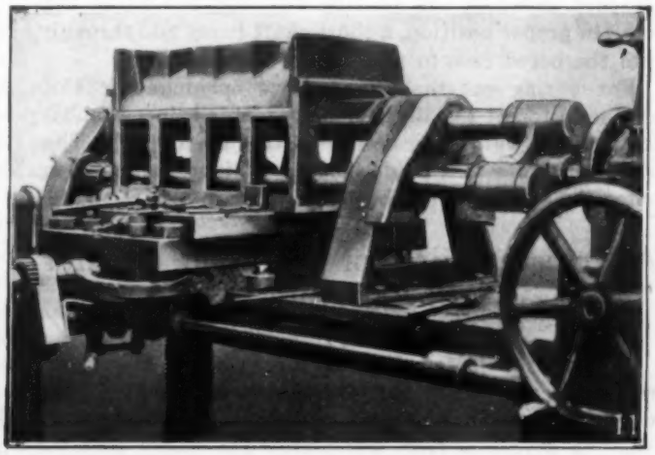


FIG. 11. METHOD OF GEARING BORING BARS TOGETHER

the box. Two clamp bolts are fixed in the fixture base, and at the top there is a swinging clamp plate which is open at one end to clear the front bolt when the nut is released.

The spindle of the machine is gear driven from the main shaft at the head end and carries a chuck in which boring bars may be readily placed to suit requirements. The outer end of the bar is supported in a long bearing, as indicated, and the bar is fitted with three cutters, one for boring and two for facing and chamfering the ends of the babbitt.

In boring metal of this kind the spindle is run at a high rate of speed and the taking of the cut through the bearing is accomplished very quickly. The two cutters for facing are filleted so that when each is fed up to bring the end of the box to length the inner corner is finished to the round desired. The character of the chips coming from this operation of boring and facing is clearly seen in the illustration.

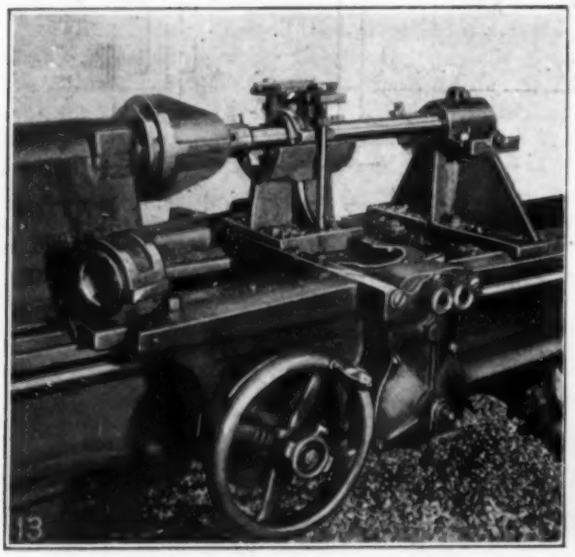


FIG. 13. BORING BEARINGS FOR CRANKCASES

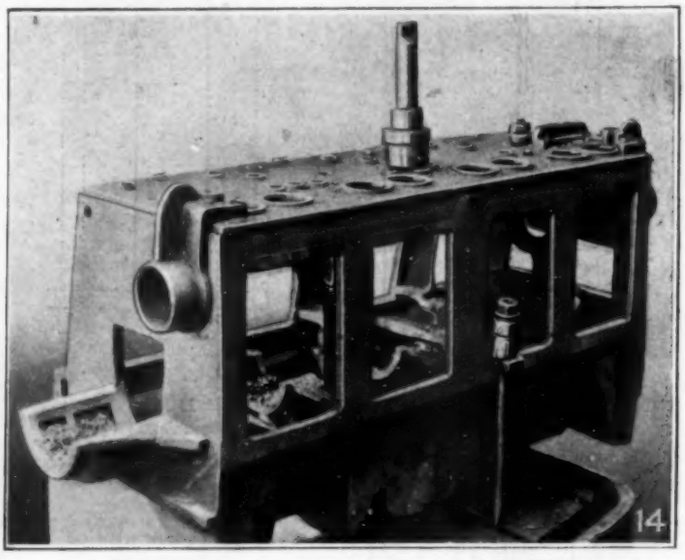


FIG. 14. A DRILL JIG WITH LOCATING BRACKETS

A simple jig used under the radial drilling machine for putting holes in the crankcase for cylinder studs, tappet guides, etc., is illustrated in Fig. 14. This jig has the usual guide bushings for the various drills and boring tools, and at the ends depending brackets are attached in which are locating bushings for fixing the work in proper position, a short shaft being slid through into the bored case to place the work correctly.

For boring out the tappet-sleeve openings the tool shown on top of the jig is employed, this being a multi-toothed tool which operates by cutting on the end. The tool carries its own guide bushing which is adapted to enter the various large bushings fixed in the jig plate.

A Reserve Source of Raw Materials for Artificial Abrasives

By Charles Eldredge

The unprecedented demand for grinding wheels by munition and other manufacturers engaged in war work has caused a serious shortage in the stock of alumina abrasives from which they are made. Because of this demand and from the fact that aluminum is also required in enormous quantities for the furtherance of war work, bauxite, the raw material from which both are derived, is becoming very scarce.

Manufactured abrasives are used almost exclusively for grinding steel because they cut much faster than the natural emery and corundum. For this reason the present shortage is felt seriously.

Emery and corundum as raw materials are, however, sources of supply that can be drawn upon for the manufacture of alumina abrasives if the necessity arises. There are extensive deposits of the former near Chester, Mass., while a large amount of a variety called "spinel" emery is to be found near Poughkeepsie, N. Y. Although the emery found in this country is of an inferior quality and cannot compete in its natural state with the manufactured product it is nevertheless valuable.

The same thing is true of corundum, which is found in large deposits in many of the Eastern states. Much of this corundum is wholly unfit in its natural state for grinding wheels because the lines of fracture are so numerous that the material crushes and crumbles readily when brought in contact with the work. This factor, however, is of no consequence if the material is to be treated in the electric furnace.

Manufacturers of artificial abrasives would of course rather use bauxite as long as this material is available in sufficient quantities to meet their needs, but as the American supply is being heavily drawn upon for aluminum manufacture and the foreign supply is practically cut off it is only a question of time before other sources must be sought.

Bauxite, owing to its amorphous nature, requires no treatment to speak of aside from calcining to throw off the excess moisture before it is fed to the electric furnace. If emery and corundum are substituted an extra manufacturing cost is entailed, as these materials are not mined as easily as bauxite and they also require crushing before they can be melted.

One prominent American grinding-wheel manufacturer at one time used emery ore as a raw material, but later substituted bauxite, as its use lowered production costs.

Projection Lantern for Thread Measurement

BY
H. L. VAN KEUREN, CHIEF OF GAGE SECTION, AND
E. C. GRIESS, GAGE INSPECTOR, BUREAU OF STANDARDS

The measurement of screw threads presents more kinds of difficulties than almost any other machine part. The apparatus here described has been developed at the Bureau of Standards and is proving very satisfactory, and in common with all developments of the bureau it is free to be used by anyone. The apparatus is easily handled and is well worth careful consideration.

WHILE devices for the precise examination of screw threads have been in use for some time they attracted little attention until war conditions made interchangeability over a large manufacturing field a necessity. Two different types of apparatus for the examination of screw threads have now been developed—those employing microscopic principles and those employing the idea of projecting a magnified image of the object being examined upon a screen.

As early as 1903 the Cambridge Scientific Instrument Co. exhibited an instrument of the microscopic type, which it built from information furnished by the National Physical Laboratory, with which by the use of cross-hairs and devices for moving the thread, or gage, micrometers to measure the motion and arrangements for rotating the cross-hairs about the optical axis they were able to determine all the necessary properties and values, namely, external diameters, diameters at the root of thread, pitch, effective diameter and inclination of V, or angle, of thread section. This instrument was somewhat limited in capacity, being adapted to the examination of screws up to ½ in. in diameter, but was followed by designs similar in principle but for much greater capacity in gage size.

The projection method of thread examination followed the microscopic method, and was used commercially for the purpose of studying the form of thread-cutting tools with a view to bringing about improvement in thread-cutting results. The apparatus was very simple, consisting of a source of strong light, usually an arc, a condensing lens to project the light rays toward the object and toward the projection lens just beyond along parallel lines. The shadow of the thread form was thrown on a distant screen, where it was traced in a fine pencil line or a photographic record was made. Great improvements in thread forms were claimed as a result of this study.

At the Bureau of Standards, where the volume of work makes commercial methods necessary, the trend is toward the projection-lantern method of examining thread form and measuring angles. Other measurements are taken more conveniently on apparatus specially designed for the various operations and by a series of observers instead of by a single observer as in the microscopic method. The projection apparatus has been developed at the bureau so that a single operator controls the lantern, makes all necessary adjustments of the gage to be examined, and measures the angle by means of apparatus, also developed at the bureau, to be described later. In this instrument the projection of the shadow of an opaque angle of known size upon the projected thread form was used for the first time.

Operation of the Lantern

The operation of the projection lantern involves the placing of the thread to be examined in a beam of parallel light and, by means of a suitable lens system, the projection of the shadow of the thread on a distant screen. In the apparatus shown in Fig. 1 the light from a 10-amp. arc inclosed in housing *A* is emitted through the condensing lens *B* and directed toward the projecting lenses *C* and *D*. The screw is placed at the focus of the lenses *C* and *D*. The projection is then directed upward by a prism *E* to a mirror (not shown) which is supported about ten feet above the prism on the column *F*. The projection is then directed down by the mirror to the top of stage *G*, which forms the screen and carries the standard angle *H* used in the examination of the thread form. As it is necessary

that the parallel beam of light pass through the thread at the helix angle in order that the shadow cast will be a true cross-section of the thread form the lamp housing which carries the condensing lens *B* is pivoted about a point beneath the lens *C*. This insures that observations it is raised until the center of the beam of light is passing the under side of the thread. The lamp is then turned about the axis of its support until the parallel rays of light emerging from the lens *B* pass through the helix angle, which is the case when the

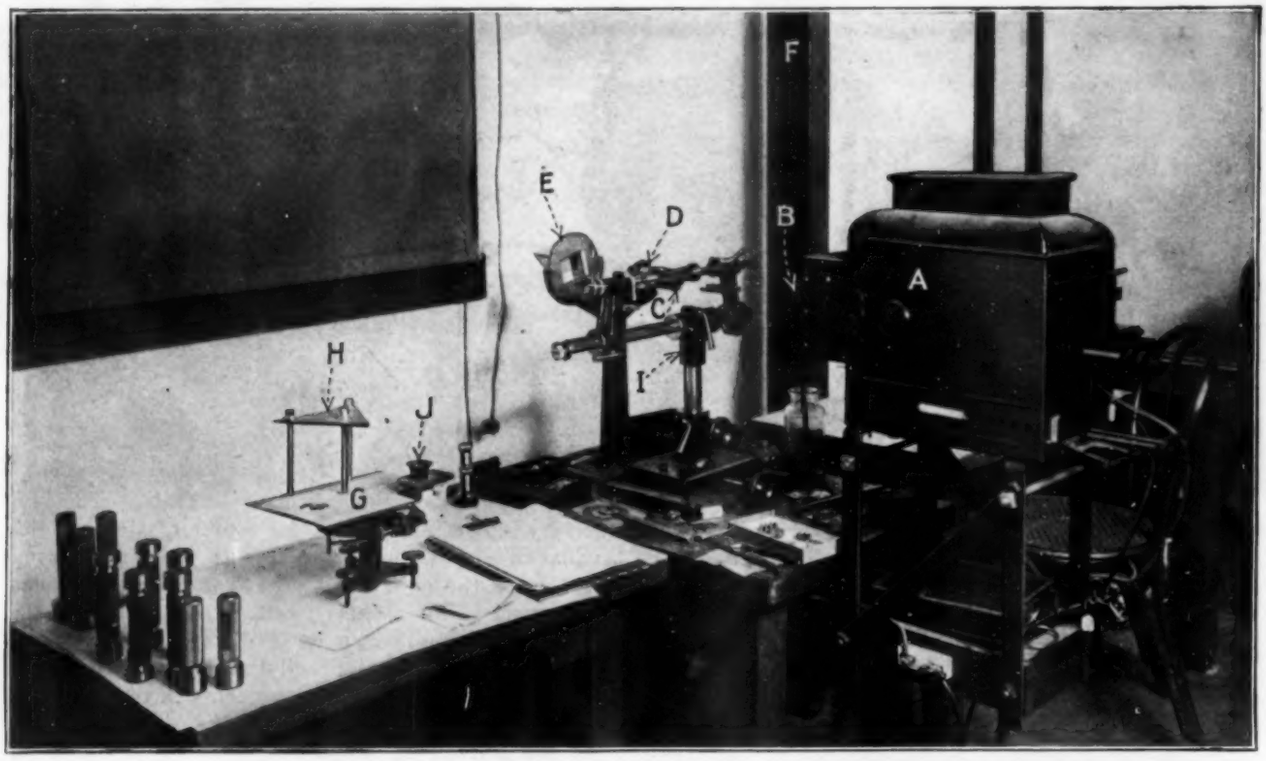


FIG. 1. PROJECTION LANTERN AND APPARATUS

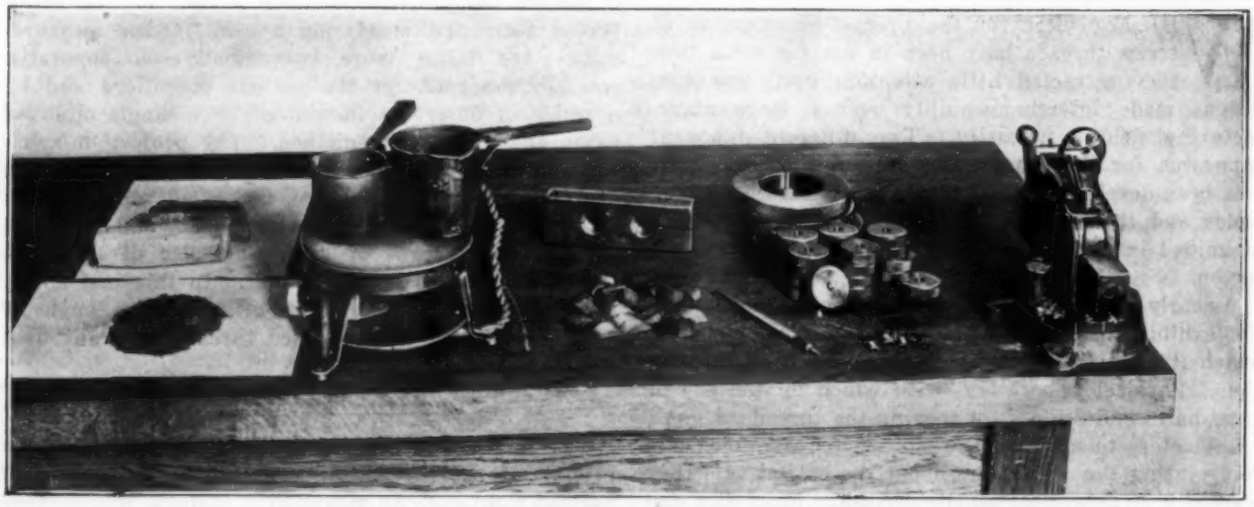


FIG. 2. MAKING THREAD-RING CASTS

the beam of parallel light emerging from the lens *B* will always be directed at and fill the lens *C*.

The setting up of a thread gage for examination requires but a slight amount of adjustment. The stand *I* is provided with a motion for raising and lowering the thread, a motion for focusing the thread and another motion for moving the thread along its axis in order that various portions of the thread may be brought into the center of the screen. The screw to be examined is supported by the spring centers which are carried on the stand *I*. For convenience in making fringe pattern which is formed about the image of the screw due to imperfect focus is symmetrical. The screw is then brought into focus by a slow-motion arrangement and the required adjustments are complete.

Examination of the thread form of rings is made by making a cast of a segment of the thread. Fig. 2 shows the apparatus required for making them. A mixture of about one part of powdered lampblack or powdered graphite and 18 parts of sulphur is heated to the fluid point in any convenient manner and poured into the lower side of a ring gage, which is held in

a vertical position in a vise the jaws of which have been faced off so that the melted mixture does not escape. The threads are carefully cleaned with benzol so that the cast may represent the real shape of the thread.

Experiments at the Bureau of Standards have shown that casts should not be poured deeper than about $\frac{3}{4}$ in. because of distortion caused by the unevenness in cooling. Shallow casts of a size just sufficient for handling are to be preferred. Care should be taken to prevent overheating the sulphur and graphite past its initial melting point, as when it is overheated it becomes thicker and imperfect casts may result. Casts of split rings of small size are very difficult to make and to remove intact from the ring, as even in this case only a segment of the ring is poured. Very small casts are mounted on a small block of wood with a drop of glue. Casts change shape gradually, and all examinations should be complete within three hours after pouring.

The casts are supported by a horizontal shelf which is arranged to rest on brackets provided on the gage support. The adjustments for examination are the same as those for the plug screw gage.

The examination of the thread angle is conveniently made with a device shown on the table in Fig. 1. With this arrangement the standard angle *H*, known to be 60 deg., is supported by three columns on the revolving stage or screen *G*, which rests on a graduated circle or protractor head. In the protractor shown in Fig. 1 the graduated circle was obtained from a theodolite. During the examination of the thread angle the opaque standard angle *H* is adjusted so that its shadow occupies the light space of the projected image which is cast on the surface below at *G*. The angle is revolved so that one side exactly matches with the shadow of the thread as cast below and the graduated head is read through a magnifying glass *J*. The gage is then shifted parallel to its axis by means of a slow-motion device on the stand *I* until the image of the other side

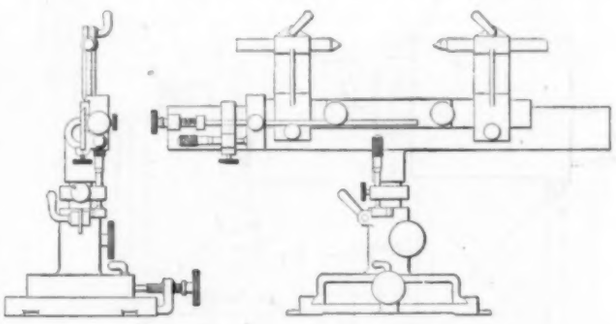


FIG. 4. GAGE HOLDER AS NOW USED

of the thread approximately coincides with the other side of the standard angle. The angle is then revolved by a slow-motion screw operating the graduated circle until it lines up with the other side of the thread, after which a reading of the graduated circle is again obtained. The difference between the two readings shows directly the error of the included angle of the thread if the standard angle is 60 degrees.

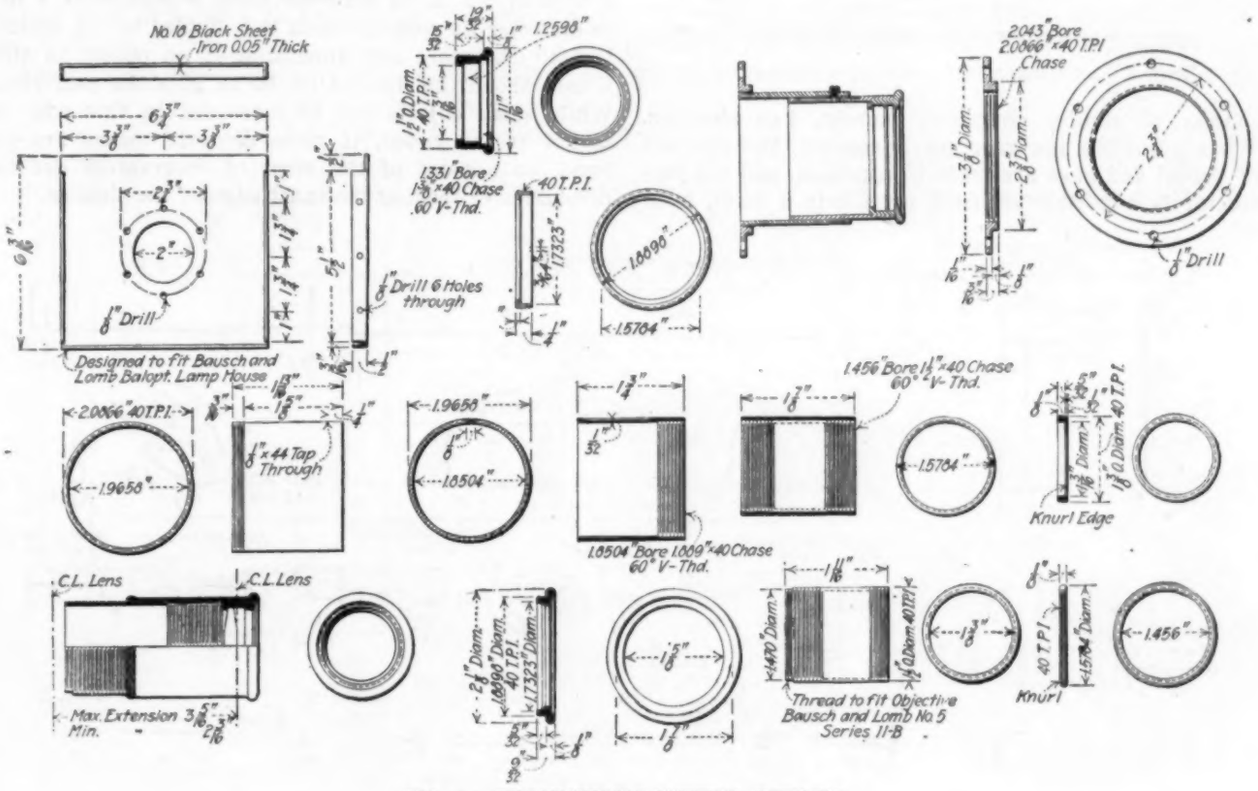


FIG. 3. PROJECTION-LANTERN DETAILS

Further application of the protractor arrangement is in determining whether the thread is symmetrical about a line perpendicular to its axis. This may be verified by revolving the standard angle and matching it with the crest of the thread or by matching a straightedge, which is placed perpendicular to a bisector of the standard angle, with the crest of the thread.

It should be specially pointed out that the "shadow

protractor" is an exceedingly effective device for the measurement of thread angles, much more so than any protractor lying directly on the plane of the shadow could be. This is because the eye is viewing two

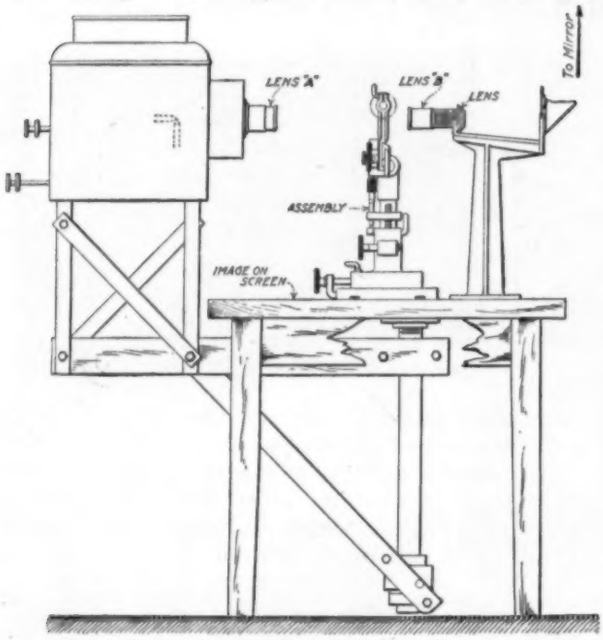


FIG. 5. ASSEMBLY OF OPTICAL APPARATUS

objects of similar character, namely, two shadows. When adjusting the gage for a reading, the shadows of thread and gage are made to approach, and the protractor is angularly adjusted until only a faint, even thread of light remains between the two. Under these circumstances an inaccuracy of but a few minutes is easily detected. The operation of the protractor is rapid, and angles of threads may be determined within from 1 to 10 min., depending upon the finish and straightness of the sides of the thread being examined. In case of particularly defective threads, exposures of the projection may be made on any photographic developing paper with an exposure time determined experimentally and a permanent record obtained of the condition of the thread.

The projection lantern is also used at the Bureau of Standards for profile measurements. For the determination of radii of circular arcs the image of the profile is thrown upon a sheet of concentric circles specially prepared for the purpose with radii varying by tenths of an inch. No difficulty is found in matching the shadow with the proper circle. The radius of the curve thrown on the screen is then divided by the magnification which gives the true radius of the curve.

Small profiles with angles that cannot be read by other means may easily be checked by the projection method with the use of the shadow protractor. Profiles with irregular outlines may be checked by means of the micrometers on the gage holder, the results being calculated or plotted to large scale with the coördinating dimensions of the two micrometers. In this latter case the object is moved so that its projected outline passes over a point on the screen. Micrometer readings for the required number of positions are taken.

The magnification may be determined by throwing an object of known size upon the screen and measuring the shadow. A wire such as is used in measuring effective diameters may be used for this purpose. If a wire of 0.1 in. in diameter casts a shadow of 5 in. in diameter the magnification is 5 divided by 0.1, which is 50. Therefore any dimension of an object on the screen should be divided by 50 to give the real size. While small objects can be measured in this way it is not recommended, if more accurate means are at hand, on account of the error of observation due to difficulties in reading the exact edge of the shadow.

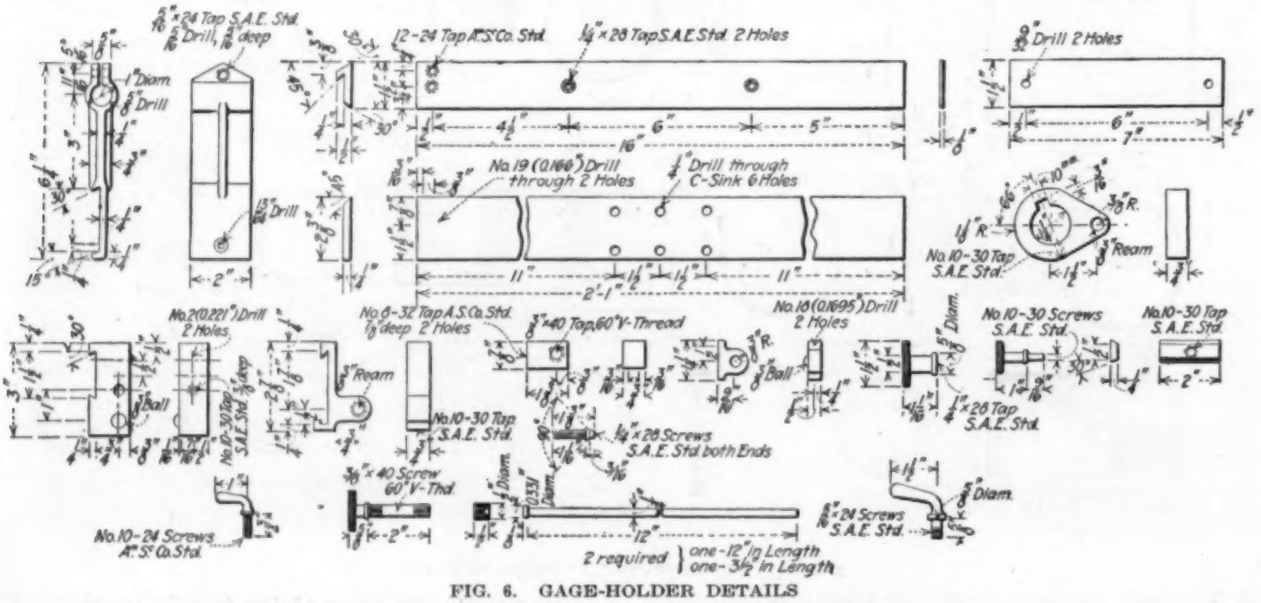

12-24 Tap A.S.Co. Std.
¼"×28 Tap S.A.E. Std. 2 Holes
Drill 2 Holes
No. 19 (0.166") Drill through 2 Holes
⅜" Drill through C-Sink 6 Holes
No. 10-30 Tap S.A.E. Std.
No. 2 (0.221") Drill 2 Holes
No. 6-32 Tap A.S.Co. Std.
No. 19 (0.166") Drill 2 Holes
No. 10-30 Screws S.A.E. Std.
No. 10-24 Screws A.S.Co. Std.
2 required } one-12" lg. Length one-3½" lg. Length

FIG. 6. GAGE-HOLDER DETAILS

The selection of the projection lens is very important. It must be free from distortion over the portion of the projected shadow employed in making measurements. It is desirable also that a short-focus lens be employed in order that a reasonable magnification may be secured with a minimum distance between the lens and the screen.

A lens that meets these specifications very well has been secured at the Bureau of Standards by combining

a 32-mm. aperture, 152-mm. focus, telescope objective (lens *C*) with a Tessar Series II-B, 4 x 5 photographic objective (lens *D*). These are mounted in a brass tube so that their separation can be adjusted to a point where the distortion effects are a minimum. The details

The screw-gage holder and protractor have been somewhat modified since the beginning, and the details given at the end of this article are for the improved arrangement. The principles, however, remain the same and no changes have been made in the lenses and

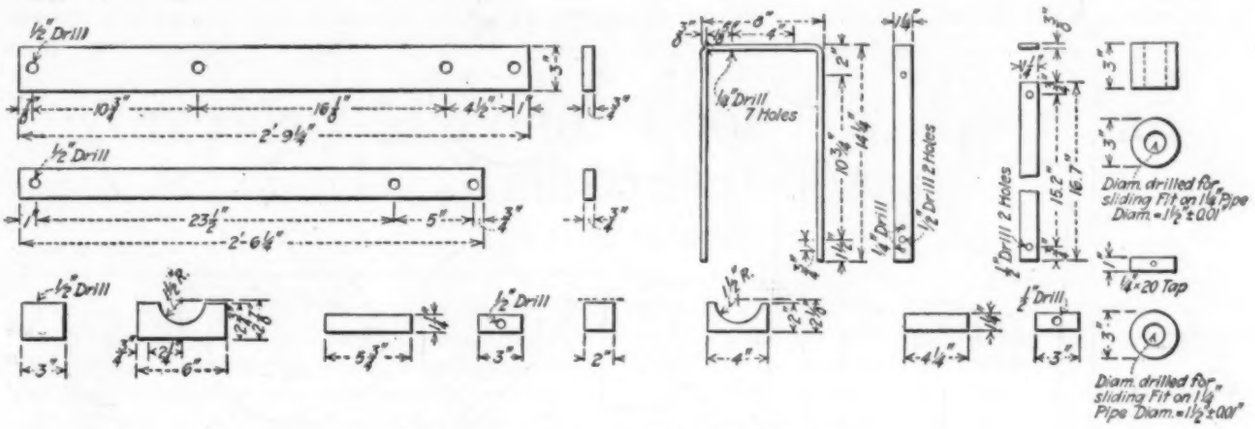

½" Drill
2'-9¼"
2'-6¼"
¼" Drill 7 Holes
¼" Drill 2 Holes
Diam. drilled for sliding Fit on 1¼" Pipe Diam. = 1½" ± .001
¼-20 Tap
Diam. drilled for sliding Fit on 1¼" Pipe Diam. = 1½" ± .001

FIG. 7. LAMP-HOUSE BRACKET DETAILS

of the mounting for lenses *C* and *D* are shown in Fig. 3. When properly adjusted these lenses have a combined focal length of approximately 100 mm., and a magnification of 50 is obtained with a screen at 5.6 meters from the lenses.

Another lens which has been used at the Bureau of

lantern, these remaining the same as in the machine first spoken of.

The gage holder, the assembly of which is shown in Fig. 4, will be found convenient, as it has a motion for focusing the screw, one for raising and lowering the screw, and also shifting it parallel to its length in

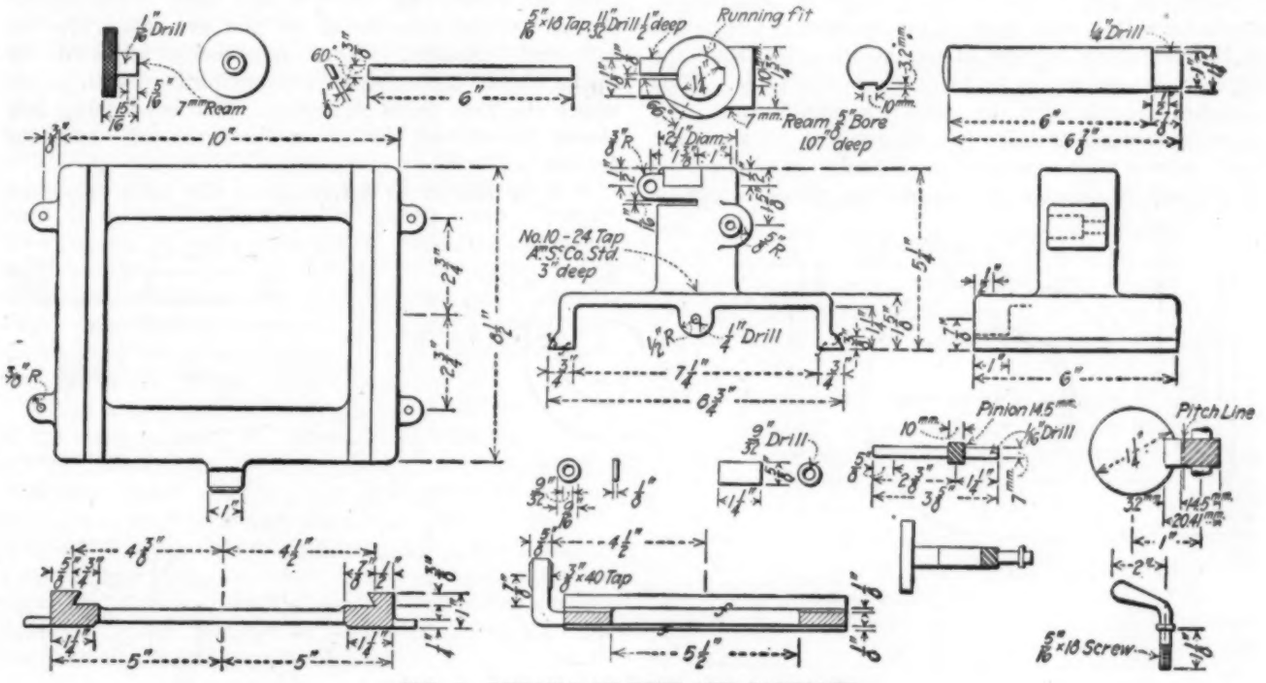


FIG. 8. DETAILS OF POST AND CARRIAGE

Standards in place of these is a Tessar Series I-C, 75-mm. focus photographic objective, which will give a magnification of about 70, with the same screen distance as with the combination of lenses previously mentioned.

For the prism it is necessary to obtain one that has its three faces accurately flat to within one wave length of light, which corresponds to about 0.00001 in. The same degree of flatness is required in the mirror, and in addition the mirror must be silvered on the front.

order that different threads may be examined. Micrometers are also provided to measure both vertical and horizontal motions of the gage.

It will be found that prisms and mirrors of the required accuracy are difficult to secure. However, convenience may be sacrificed and the prism and mirror omitted. The image is then thrown horizontally onto a vertical screen and the same measurements made. While the bureau has not developed a form of shadow

protractor for vertical images it would not be difficult to arrange the protractor in use here for that purpose.

The setting up and adjustment of the various parts of the apparatus are not difficult. From the standpoint of operation all the elements, except the reflecting the drawing. It must be directly over the image which it throws on the table or screen.

To test the adjustment of the condensing lens with respect to the position of the arc to secure parallel light the lantern should be lighted and a cloud of smoke

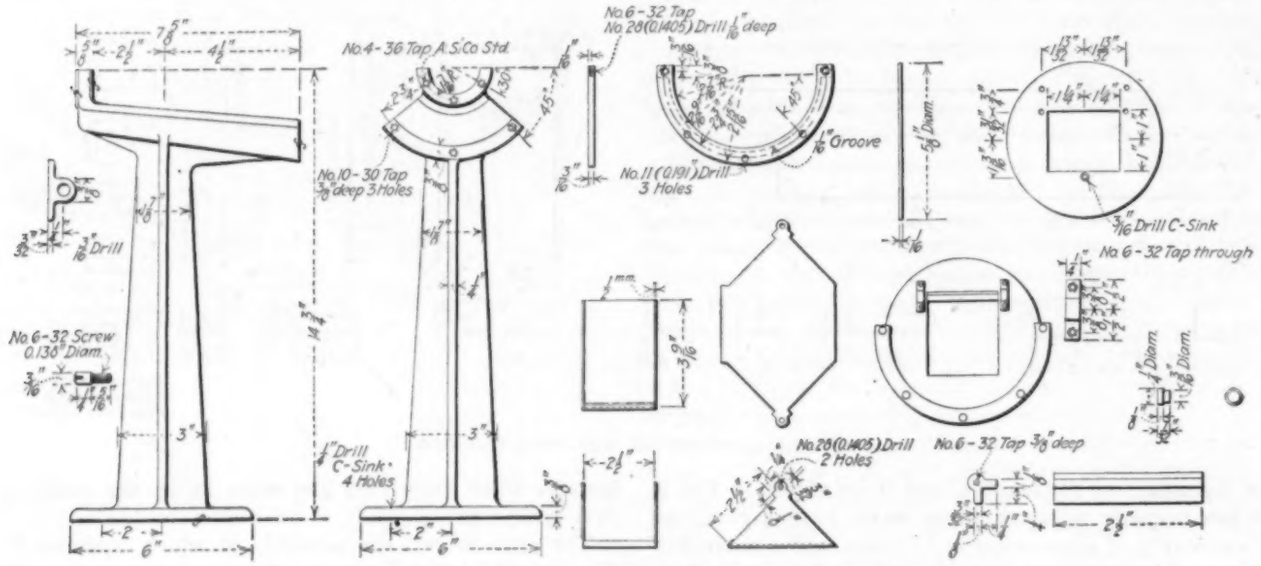


FIG. 9. DETAILS OF LENS AND PRISM SUPPORT AND OF HOLDER

mirror which is suspended some distance above, and perhaps the prism which rarely requires adjustment, should be within easy reach of the operator. The center of the reflecting mirror should be directly above the circular image which it throws on the table. This may be secured with the aid of a plumb line. The prism mounting permits the adjustment of the light beam over a wide area and no difficulty is experienced in placing it directly on the mirror above, which is from a pipe or a cigar blown into the beam emerging from the condensing lens. If this beam is parallel, as far as can be determined by the eye, the rays are sufficiently parallel. When improperly adjusted the smoke reveals diverging or converging rays with points where the rays focus and cross. The condensing lens should be shifted toward or from the arc until the desired condition is obtained.

If it is desired to determine if the table or screen

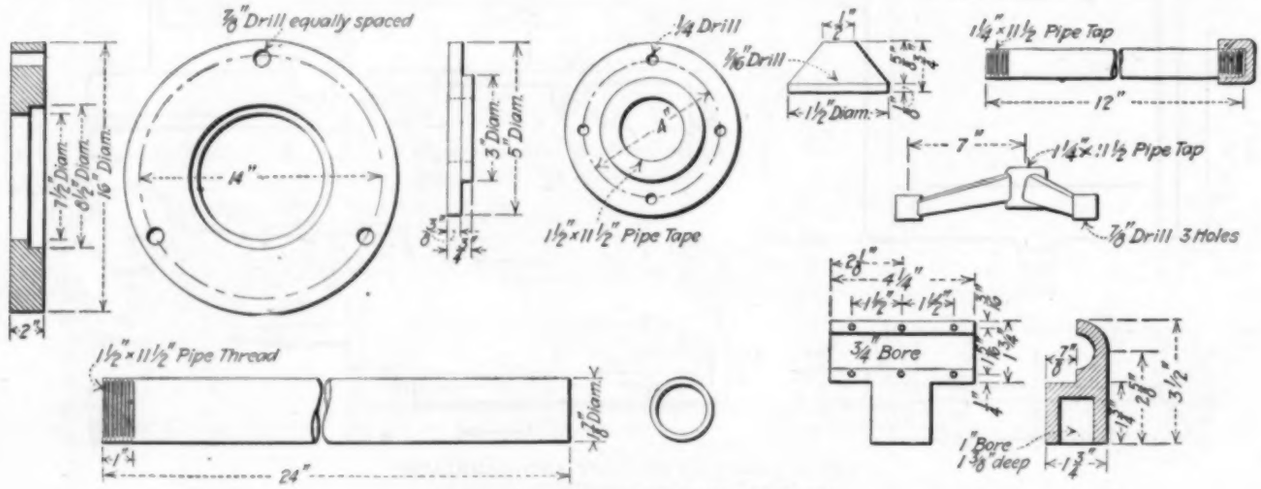


FIG. 10. MIRROR-SUSPENSION DETAILS

provided with adjustment arrangements to take care of any changes caused by changes in the prism. The distance between the lantern and the projection lens may vary widely and still permit successful operation. The assembly shown in Fig. 5 suggests the approximate location of the various parts as they are now placed in the set at the Bureau of Standards. The mirror is not shown, but its relative location is suggested on is perpendicular to the center line of the projection system it may be done as follows: Remove the projection lenses *C*, Fig. 1, and *D*, allowing the light from the condensing lens to pass through straight. An ordinary mirror should be placed on the table or screen to reflect back the light thrown on the screen. When this slight is thrown back into the lantern the table is perpendicular to the center line of the rays. The

latter may be tested by holding a card at the condensing lens which covers half of the beam emerging. When the back of the card is light from the returning beam the correct condition has been secured.

For the convenience of those who may desire to construct a duplicate of this apparatus a detailed ordering list will be supplied on application to the bureau.

For information as to the construction of the gage holder, lantern bracket, lens and prism support and other parts not purchased see Figs. 6 to 10 made from drawings of the Bureau of Standards. The drawings of the protractor are not included in this list, but will be furnished if request is made to the Bureau of Standards, Washington, D. C.

American Machine Tools for Australian Railroad Shops

BY L. W. SCHMIDT

The Australian railroad shops present interesting possibilities for the American machine-tool builder who studies the situation and takes intelligent advantage of after-the-war conditions. This article is enlightening in many ways.

MACHINE-TOOL makers in this country have noticed since the outbreak of the war an increasing interest in American machine tools on the part of Australia. Shipments in this direction have been particularly large during 1916 and 1917, but were less active during the present year. It is now expected that a renewed activity may be expected in business with Australia, New Zealand and Tasmania. Most of the recent orders have come from the railroads. As in most other countries the railroad system of Australia and other British dominions in the Pacific has been much strained by the increased demand for transportation facilities caused by the war. The repair shops, therefore, have been busy and additional equipment has been in demand. Much of the repair work formerly done abroad is now accomplished in Australian shops, as it has become necessary to construct locally equipment that in former years was imported more conveniently. The result has been an increase in efficiency in the railroad-construction shops of Australia and a general improvement in machine equipment.

With the new equipment it will be possible to do most of the construction work in connection with the renewal of the rolling stock of the railroads in the local construction shops. Also there is now noticeable a tendency of the governmental railroads in Australia to order railroad equipment from Australian manufacturers. The result in both cases must be an increase in the demand for high-class shop equipment and metal-working machines of all description, which promises well for the American machine-tool builders.

LEADING AUSTRALIAN RAILROAD REPAIR SHOPS

According to a report just published by the Department of Commerce the state-owned railroad-construction shops are fully equipped to erect a considerable part of the new locomotives, passenger carriages and goods wagons. The same report deals fully with the question of railroad construction and repair shops in Australia, of which there are a great number.

The central repair shops of the New South Wales Railroad system are located in Sydney, where there is a railroad repair shop at Eveleigh and a tramway repair shop at Randwick. There are also large repair shops at Newcastle in New South Wales. All the plants are well equipped for the work they do, and a great number of American machine tools are employed.

The Victorian Railroad system has its principal repair shops near Melbourne, in Newport. The present yearly output of this plant, which employs about 5000 hands, amounts to 50 locomotives, 100 passenger carriages and 1000 goods wagons. To supplement this production and to facilitate repair work additional shops are under construction at Ballarat and Bendigo.

Queensland has its leading repair shop at Ipswich, near Brisbane. The plant is one of the best in Australia and excels especially through its completeness. Its total area is 15 acres and 3000 men are employed. All kinds of railroad material are manufactured, including essential shop stores. American machines are used in all departments, and there are especially many American-made wood-working machines. Division repair shops are located at Rockhampton, Mackay, Townsville and Cairns.

The repair works of the South Australian governmental railroad system are located at Islington, near Adelaide, and of the Western Australian system at Midland, near Perth. The latter plant is one of the best equipped general-construction shops of Australia and a great number of American machine tools are to be found there.

Practically all the railroad repair shops of the Australian continent are well equipped and use modern machinery. Electrical power is used where obtainable to drive the metal-working machines and additions to the existing equipment are made frequently. Generally speaking the Australian shops make their machine equipment go a longer way than would be considered good policy in the United States. But against this it is pointed out that new equipment is more costly in Australia and less easily obtainable than in America and Europe. New machines, therefore, have to be carefully tested before their purchase is advised by the engineers.

Today the best outlook in Australia is for the special-application machine tool. The Australian railroad machine shops are compelled by the war to do more manufacturing than in former years, and therefore are undergoing a slow change from the repair-shop methods to manufacturing methods. This is noticed by the United States Commercial Agent especially in the workshops of New South Wales, which produce at nearer a manufacturing basis than any other of the railroad construction and repair shops of Australia.

The tendency in favor of manufacturing and the resulting necessity for the employment of special-purpose machine tools may finally also revolutionize the methods by which machine tools are sold in Australia. Until recently most sales have been made either by the aid of catalogs or through the recommendation of engineers who had a special knowledge of the qualities of the machine tool in question. The installation of one machine tool of American make in an Australian repair shop as a rule was followed by a series of orders for similar tools from other repair shops. Now a more intimate and special knowledge of the demands of the industry will be needed. Machine tools will have to be sold with a greater consideration for their future application, and the time will come when Australian repair shops will ask for machine tools especially designed for their particular needs. This will make essential personal representation in Australia and a close study of the local conditions. Also more attention will have to be given by the exporter to the question of installation. Where local representation is available the representative in each case will have to see personally whether the tool has been properly installed, so as to give the most satisfactory result to the buyer.

Principal Repair Shop of Tasmania

Tasmania has its principal repair shop at Launceston, the location being selected for this purpose owing to its central position. The equipment of the shops is described as not of the newest type, but still able to handle the work. The New South Wales government owns excellent shops at Newmarket, near Auckland; also at Petone, near Wellington; at Addington, near Christchurch, and at Hillside, near Dunedin. At the present time a rearrangement of the activities of these plants is under way, which finally will lead to a greater specialization of individual undertakings. This will necessitate also a reformation in the machine-tool equipment of the different shops, which so far has been somewhat neglected, principally owing to the high cost of new equipment and the difficulty of obtaining well-trained labor. New South Wales, therefore, may become a very active buyer of machine tools in the near future, at least immediately after the conclusion of the war.

At present the principal factor acting against the extensive employment of American machine tools in Australian railroad shops is the close relationship between Australia, the government of which owns the railroads, and England. It is only natural that orders for new machine-tool equipment will be given to English makers in preference, and American makers have against this argument of sentiment no other than that of superior quality, which, however, must be proved to the satisfaction of the buyer.

Having been successful so far with the introduction of their machine tools American makers have no cause for complaint. They will most likely find in future that the demand for their tools will increase even above the satisfactory demand of past years. Local representation will do a good deal to combat the sentimental argument, and if native representatives can be obtained these will be able to hold the market for the American maker. No doubt the American position in Australia has been very much improved by the entry of our country into the war on the side of the Allies. By doing so the American manufacturers have acquired a right to be treated by Australians as friends, and they very soon will reap the benefit of this favored position.

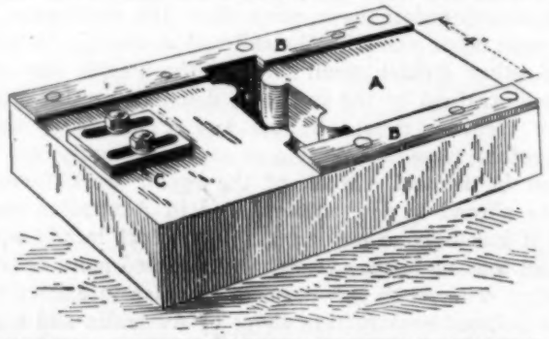
The leading positions in Australian railroad engineering are now practically all filled by Australian engineers. Most of these, also the younger men destined to fill those positions when they become vacant, have learned their trade in England. Likewise it is a decided advantage for the American machine-tool maker that today more American machine tools than ever are employed in English shops. Every machine tool sold to an English shop also acts as an advertisement for further sales to Australia.

An Adjustable Punch and Die

By G. R. Smith

I read with considerable interest an article on page 314 of the *American Machinist*, by A. E. Holaday, on an adjustable punch and die, and I emphatically agree with the editor's footnote that it is very doubtful if such a tool would stand up. Aside from its cost and the skill and time required to make it, I consider the design impracticable, as a very simple one-piece punch and die fitted with an adjustable stop gage will do the work perfectly and stand up indefinitely. A sketch of this die is here shown and I will leave the question of its superiority to the reader.

I have used dies of this design on similar work for years, work that has required very close limits, and



DIE FOR CUTTING VARYING WIDTHS OF BLANKS

both the punch and die being made of solid blocks of tool steel it is capable of producing millions of blanks. I would advise cutting these blanks from strip stock 4 in. wide, which may be bought sheared to size very accurately, thus reducing the scrap factor to a minimum.

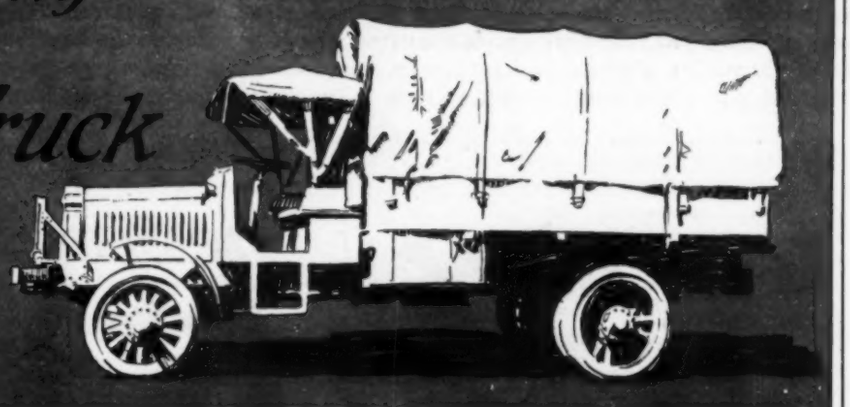
The stock is passed over the die *A* (which in the figure is shown with the stripper plate removed), and between the guiding ways *B* up to the adjustable stop gage *C*. As the end of the front guide is cut off, the operator can easily remove the blanks from the front of the die, the stripper also being cut away to facilitate this removal and the adjustment of the stop gage.

With a die of this design a blank of any desired width may be cut, a thing that is impossible with Mr. Holaday's die. The production in any up-to-date press room with experienced help will be from 1500 to 2000 blanks an hour.

With apologies to Mr. Holaday I would ask him to try this design, which any good toolmaker can make in a day.

Assembling the Liberty Truck

By M. E. Hoag



The assembling of a 3-ton motor truck from component parts received from various sources is here described. The work is so arranged that, starting with the sills at one end of the factory, the work is moved forward progressively, the various units being added at the respective stages of the progress until having reached completion the truck is run out of the shop under its own power and is ready for testing.

OWING to the fact that the various units of the Liberty truck are manufactured in separate factories with facilities for specialized work and are then shipped to assembling plants throughout the country for final assembling and testing, a detailed description of the mechanical operations on the various parts would require an article in itself. It is not my intention to give details of these operations but rather to give the reader a general idea of the construction of the truck of which so much has been said in the newspapers, but of which so little is really known. In some instances, as every good American will understand, it is not advisable to go into minute details nor to show the dimensions or construction of the various working parts.

FIG. 1. THE HILL-CLIMBING TEST

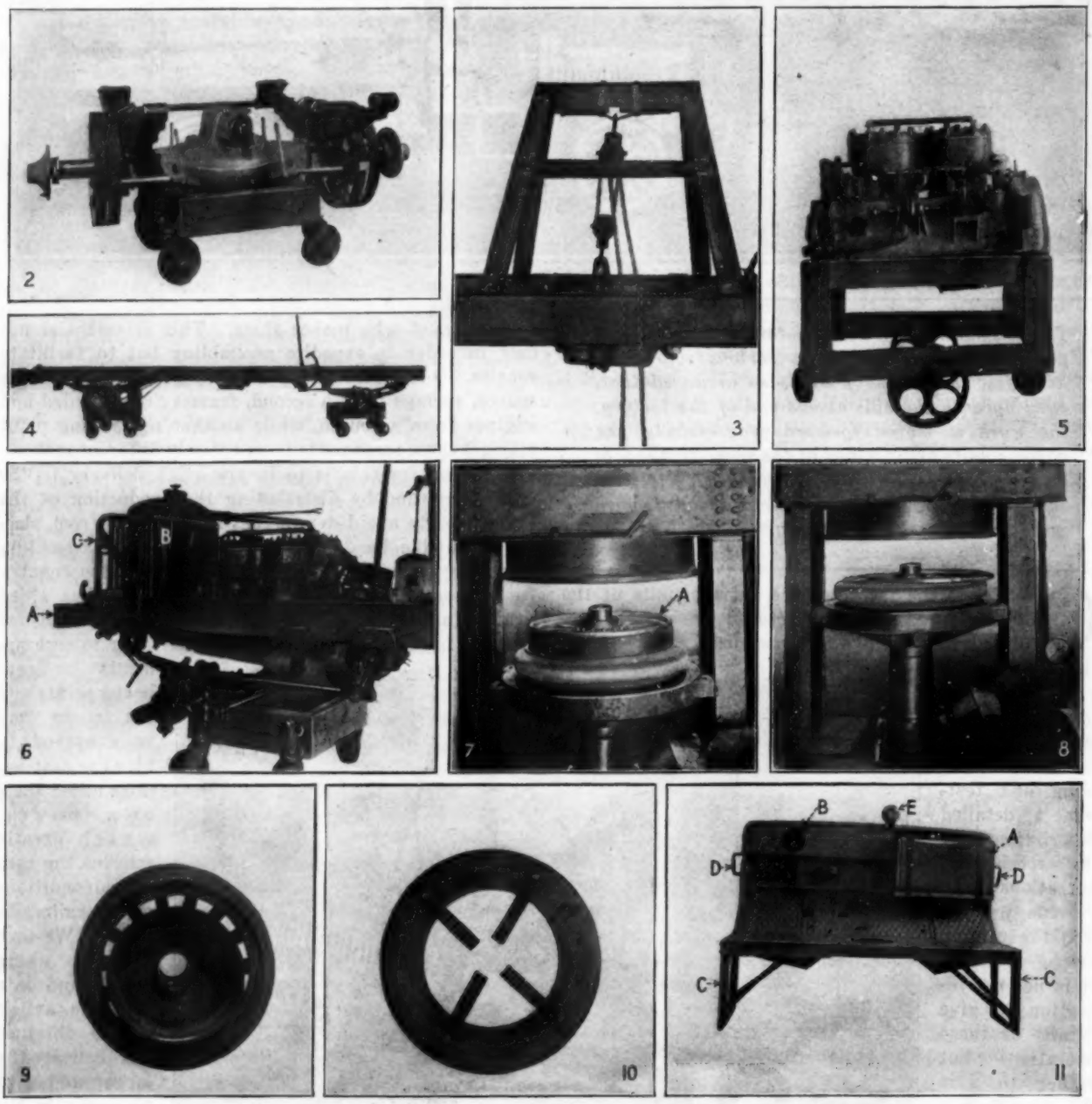
All units are of standard construction and design, regardless of who makes them. This is essential not only in order to expedite assembling but to facilitate repairs. One assembling plant may get axles from one source, springs from a second, frames from a third and engines from a fourth, while another assembling plant may get these same parts from entirely different makers. The reason for this is to insure quick delivery to the assemblers, and by distributing the production of the various parts avoid delays that might arise from placing an undue burden on one plant. The assembling plants have also been well distributed over the country for the same reason, and this distribution has aided greatly in making possible the quick delivery of finished trucks. In many cases these plants are near to encampments or seaboard points and the trucks may be conveyed to their destinations under their own power, which greatly relieves the congested conditions of the railroads.

The Western factory where photos and data for this article were obtained has delivered a large number of trucks to the French government, and as their entire plant was being run to capacity on trucks of another type it was found necessary to utilize a warehouse in order to handle the Liberty truck. This plant therefore cannot be taken as a fair sample of this firm's general methods, but it does show how American manufacturers are working in order to aid the Government

in every way. That they are succeeding is evidenced by the results obtained, results in many cases which the general public at present knows little about.

The Style B truck is of three tons capacity. The weight loaded and fully equipped is about ten tons. The rear axle weighs 1200 lb., and each rear wheel 650 lb. The bed and cover weigh about 1500 lb. These figures are sufficient to show that the truck is built to stand service, and with a governed speed of 15 miles an hour it is as fast as practical for a truck of its size. The engine power is ample, as may be seen from the hill test shown in Fig. 1. For this test the trucks are loaded with 7500 lb. of ballast, which accounts for the 6000-lb. load capacity and the bed and top, which are not put on at this time. The road on which these tests are made is a long and steep hill with a roadway of soft dirt. The trucks are driven partway up the hill; then stopped and again started under full load, and from all appearances they could perform the same test under double the load they carry.

The frame as received from the manufacturers requires the addition of the transmission hangers, steering-gear hanger and the motor hangers. These parts are riveted on in the basement of the plant. The frame is then lifted by an air hoist through an opening in the floor above, and the rear axle is run under on the dollie shown in Fig. 2 and bolted to the hangers. The frame is then lowered onto the front axle, which is also on a dollie, and while the assemblers are working on these parts a third man swings the transmission into place



FIGS. 2 TO 11. VARIOUS STAGES IN ASSEMBLING THE LIBERTY TRUCK

Fig. 2—Rear axle assembled on dollie. Fig. 3—Lifting the transmission. Fig. 4—Frame and axles assembled. Fig. 5—Motor on assembling truck. Fig. 6—Front end of truck assembled. Fig. 7—The tire press. Fig. 8—A tire pressed on. Fig. 9—Rear wheel and brake drum. Fig. 10—Assembling jig for setting brakes. Fig. 11—The dashboard assembled

with the simple rig shown in Fig. 3, and follows up with the steering post and drag link.

It will be noticed that all heavy parts are carried on dollies, or trucks. This was found necessary because it was impossible to place traveling cranes in the building. These trucks are easily moved and permit easy passage of the parts through the progressive assembling where each man has his particular work to do. A frame with axle, transmission, etc., is shown in Fig. 4.

The Motor

The engine is shown in Fig. 5, and as received from the manufacturer requires the addition of the fan, cable tube, magneto and distributor cables, high-tension wires, motor front-support long radiator hose to pump, spark, throttle, control rods and brackets, foot control, priming cocks, spark plugs and transmission control. This leaves the motor ready to swing into the frame, as shown in Fig. 6. The wheels as received are not equipped with tires. The front wheels carry single tires and the rear wheels double ones, these being put on with a hydraulic press under 35 tons pressure as shown in Figs. 7 and 8. Fig. 7 shows the tire and wheel in place on the press, the steel ring *A* being placed on the rim of the wheel in order to force the latter into the tire the correct distance. Fig. 8 shows the wheel and tire after pressing on, with assembling ring removed. In Fig. 9 is seen a rear wheel with tires and brake drum assembled ready to mount on the axles. Before mounting the rear wheels the brakes are adjusted with the use of the jig shown in Fig. 10, which consists of a standard-sized brake drum with four steel bars bolted on and turned out in the center to fit the axle. This makes the adjustments much easier to handle than they would be if made with the wheels in place.

The Dash Assembly

The dash assembly, shown in Fig. 11, is handled on wheeled trucks and requires the placing of the gas tank *A*, headlights, wiring, the instrument *B*, steps *C*, handles *D* and horn *E*. The foot boards of pressed steel require no assembling work other than dropping them into place. The main gas tank is carried on the dash as shown, but there is an auxiliary tank under the driver's seat, giving a combined capacity for the two of 36 gallons.

Referring again to Fig 6, the bumpers *A* are put in place. The radiator and fan hood *B* are assembled and the radiator guard *C* put on, the radiator and pump are connected and the wiring and operating levers and controls connected. The engine and all parts of the transmission are now connected up so that the truck is capable of running under its own power. As soon as the wheels are assembled, inclines are placed under them and the truck started, which raises it sufficiently to allow removal of the dollies on which the axle and truck have been handled up to this time.

All of the separate units which are to be painted have two coats of primer before assembling, and after all parts are in place ready for the top and body the truck is run into a hood fitted with exhaust fans, where all parts are given a coat of paint with the airbrush. The trucks are then ready for the final inspection and tests before placing the top and body, which have been assembled separately in another department.

Jack to Bill

Dear Bill:

Ive give up awl idear of bein a flyoplain capptin and I bleev the hoal biznis is rotn with Hun spize, Huns is Jurmans, Bill, and Ile tel you how I no. I went to taik my exanimation and too geezurs toald me to stripp and I dun so and one says sumthin like Ahk eel ay sahl and the uther he says Eel ma fay mal der ker and poots his hand to his fase and runs and oapens a winder and wen I ast Wat kine of tawk is that he sed It meens how strong you be and I no he lide, eels bein fishis like snaix and no great for strenth that I evver hurd of and wy shood my beein strong as you no I be, me wurkin so hard, maik a man oapn a winder? and I bleev he was signerlin to an uther spie outside.

And thay shure treetid me ridiklis maikin me hop bline foaldid awl kines of ways and stan with one foot on the uther and then with the uther on one to see if Ide fawl and hop backwuds on one foot to see how neer I cood cum to a marrk on the flore, and wen I slipd on a mach I bleev thay poot thare on purpus one of them feends in humun form sed Strong as he is be has met his mach.

And thay onblindid me and set me in a chare with a pivit and a moater to wirl it and sed Now Ile blinefoald you and wirl you and then you point ware I be and I dun so and he sed Are you dizy and I coodent anser promt me havin a chew in and I reremberd ware I seen a cusperdoré—wy do they call them that, Bill, thay havin no dores or eether spit tunes thay playin no musik—and I gess I fechd the signerlin spie for he cussd and run to an uther room and I hurd him set the wotter arunnin and I hoap I got him good.

And thay took off the blinefoald and ast if I was dizy now and I sed No wy shood I be me nevver drinkin nothin but a litl beer and thay sed that indercaitid serbral defishunsy, them same fatul wurds, Bill, wat the eye tesstin gink in the shop sed, and Ide be of no yuse on a flyoplain. And if I wood purr sevear—wat did thay meen by that, Bill, I aint no cat—I mite git into the mekannikle branch of the survis but my tallunts wood be damneer waistid thare, and Ide betr trie for the navey. But you no how it is, Bill, litl things sujest bigg idears if youve the mine to see em and I rode in the subway and ast a kine man wat maid the carrs go, thare bein no trolis, and he shode me how the moaterman terned a litl bit of a crank and toald me that maid awl the lektristy to run the tranes. Aint siuns wonderfle, Bill, and how glad I be I lernad awl abowt lektristy, me runnin a moater-drivn laithe, and my idear is to inlisst in the navey for thay shure musst nead good men like I be to run the lektristy masheens and to maik shure I ast a saler if thay yused lektristy in the navey and he sed Ohelyes they eavn cooks our chow bye it. And I havent qite enuf munny to git to ware thay inlissts and wood you lone me say a 10$.

Yors truley

JACK.

P. S.—Bill Doant send it by male, the males is runin slo, for I rote a man wat ohs me a 5$ a weak ago and it aint come yit, nor by tellygraft for some of them shaks on the frate tranes mite swipe it offen the wiers but by xpres.

The Caproni Air Cruisers

By HENRY WOODHOUSE
Vice President of the Aerial League of America

The huge Italian Caproni bombing machines have been a revelation to many. The views shown in this article give some of the latest types and also a number of official Italian photographs taken in the Caproni factory.

"AIRPLANES twice or three times the size of the present ones are impossible because as the size of the wings are doubled the thickness of the wings must also be doubled, and you soon reach the point where the airplane can only lift its wings."

The above argument was advanced everywhere against large airplanes until recently, and it resulted in delay in building large airplanes.

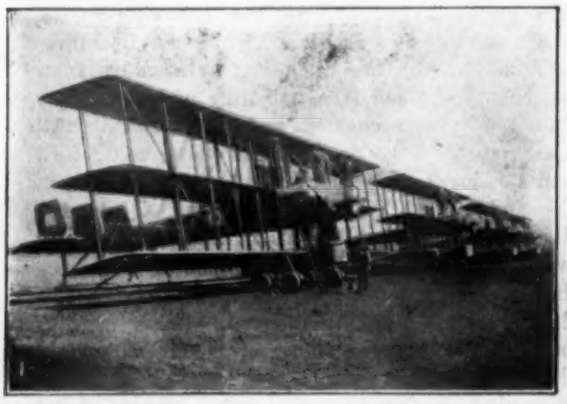
As late as March, 1917, when Admiral Fiske urged the building of large torpedo planes he was begged by "experts" not to risk his wonderful reputation by urging something mechanically impossible. Immediately after the country was thrilled with the cross-country flights made by Captain Resnati with a Caproni biplane, which was sent to the United States with a larger Caproni triplane by the Italian government to demonstrate the value of large airplanes. One of Captain Resnati's flights took him to Washington, where the machine was held on exhibition for a number of days. While it was on exhibition Admiral Fiske went to see it and received an offer from the Italian authorities to use the machine to conduct his experiments in launching torpedoes.

Those who said large airplanes were impossible had failed to take into consideration the fact that the wing of the average-sized airplane weighs a fraction over 1 lb. per square foot, and is supposed to lift close to 10 lb. per square foot at the normal lift-drift pressure, so that if the thickness and weight of the wing should even be trebled the argument advanced against the large machine would still be fallacious. But as a matter of fact, in judging large airplanes it is absolutely necessary to consider that on the whole they are more efficient than small ones because they lend themselves to many more improvements in wing curves, stream-line members and mountings than do small machines. It may also be considered that there is a rather great saving in weight in that it is not necessary to have three sets of instruments and control wheels because the machine is three times as large as the average-sized machine, nor is it necessary to increase the weight of the engine mountings by three or four times because the machine is three or four times larger than the average airplane.

I recall how Prof. Simon Newcomb in 1902 "proved beyond question" that it would be "impossible" for a heavier-than-air machine to rise from the ground.

After the Wright brothers made their first flight on Dec. 17, 1903, and for five years after, people all over the world disbelieved that an airplane could actually fly. Some admitted that it could rise, like a skipping stone, but would be unable to turn in the air. The reports of the Wrights' circular flights before 1908 were not believed, and the circle of Henri Farman in France in 1907 was held as being a stunt. Then in 1908 Wilbur Wright proved beyond doubt in his flights in France that circling was part of flying. He took the word "impossible" out of the aerial dictionary.

Only six years ago when the Aero Club of America offered to order several airplanes to compete for the International Aviation Trophy and required that the airplane make a speed of 100 miles an hour it was criticised very generally by people who held that airplanes could only be used for scouting, and that for that purpose a speed of from 50 to 60 miles an hour was best. They held that beyond that speed the observer could not get a good view of what was going on below him. When the Aero Club of America authorities answered that speed would be one of the principal factors in military airplanes, because they would be employed in fighting and for bomb-dropping, the so-called authorities then asked, "What will you fight with—your fists?" The Aero Club authorities stated that machine guns and bombs would be used, and the technical obstructionists presented mathematical computations to show that the recoil of a gun and the dropping of a bomb weighing more than 50 lb. would upset the airplane. We know now that it does not, but many people believed them.



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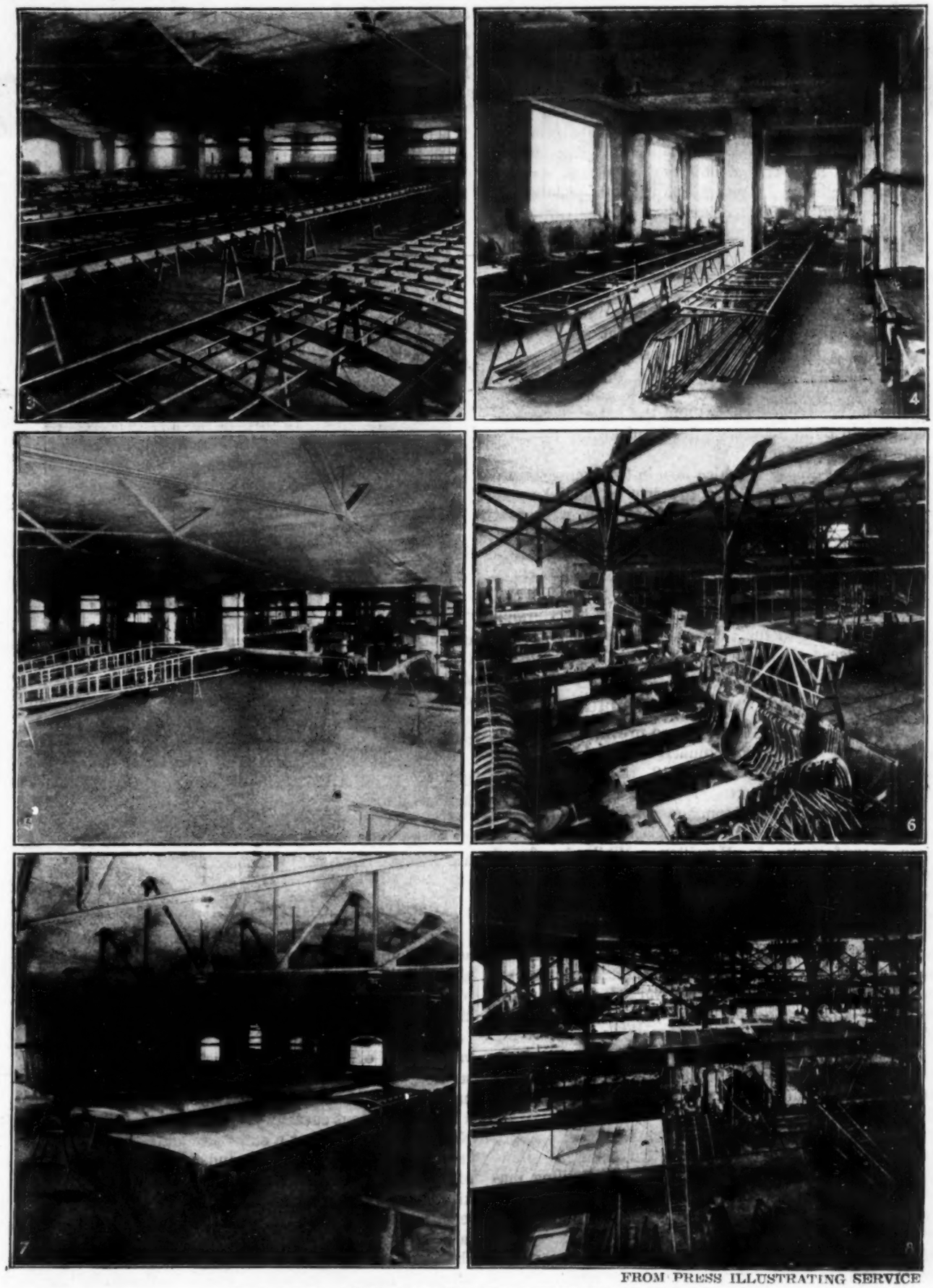
FIGS. 1 AND 2. TYPES OF CAPRONI AIRPLANES
Fig. 1—Caproni triplane bombing machine. Fig. 2—A Caproni wasp and its big brother



FROM PRESS ILLUSTRATING SERVICE

FIGS. 3 TO 6. VIEWS IN THE CAPRONI ITALIAN FACTORY

Fig. 3—The wing assembling room. Fig. 4—Tail-plane assembling room. Fig. 5—Fuselage assembling room. Fig. 6—Under-carriage or landing chases assembling. Fig. 7—Where the fabric is attached to the wings. Fig. 8—Machines almost completed

Those who expressed the possibility of equipping airplanes with two or more motors were considered visionary, and again mathematical computations were presented to show first that a machine equipped with two motors would be unable to lift its own weight, and second that if one motor stopped, the other would make the machine spin around and, presumably, disaster would follow.

The United States is indebted to Caproni and his very able representatives, Capt. Silvio Resnati, Capt. Ugo d'Annunzio and Leopoldo Belloni, for demonstrating the value of the large machines and proving that large machines do not grow old while they are being manufactured, as is often the case with small machines—because large machines can be used for night bombing, when they cannot be seen by the enemy, and therefore do not have to fight the enemy's combat airplanes or to continually dodge the fire of antiaircraft batteries. The only time that the latter has to be done is when the bombing begins and the enemy's searchlights search the sky for the bombing airplanes and the antiaircraft batteries try to build a barrage fire to make the progress of the bombers difficult.

The Caproni airplanes which flew in this country were over two years old, but they are just as useful today for night bombing as they were when they were first brought out.

This does not mean that the Caproni institution has not brought out improved types. It has brought out a number of improved and larger—much larger—types, and the daily reports of activities against the German forces show that all the Caproni types are performing marvelous deeds.

Sherman Cornelius Schauer

Sherman Cornelius Schauer, once president and general manager of the Cincinnati Bickford Tool Co., Cincinnati, Ohio, died Oct. 11, 1918. Mr. Schauer was born in Hamilton, Ohio, Nov. 13, 1865.

Upon completing his common-school education he entered the drawing room of the Cope & Maxwell Co., pump manufacturer in Hamilton. While he found this work interesting it was not long before he realized that it was more important to learn what to draw than how to draw, so when the Bentel & Margedant Co., manufacturer of wood-working machinery, offered to make him an apprentice machinist he accepted at once. After serving his time with this concern he removed to Cincinnati, where he worked first for the old Lodge & Davis Co. and later for the Lane & Bodley Company.

His earliest business venture was at Aurora, Ind., whence he returned to Hamilton to become superintendent of the Hamilton Machine Tool Co., remaining there for eight years.

On Nov. 20, 1898, Mr. Schauer, in conjunction with August H. Tuechter, founded the Cincinnati Machine Tool Co., for the manufacture of upright drilling machines.

Among the many improvements developed by him are the friction back gear, positive-geared feed box, geared tapping attachment and wormwheel elevating mechanism. His company also brought out the modern high-speed, shaft-driven upright, the merit of which is attested by the award to it of gold medals by the Pan-American and West Indian Exposition, 1901-1902; the Exposition Universelle, Liège, 1905, and the Eposizione Internationale di Milano, 1906.

On Feb. 11, 1909, the Cincinnati Machine Tool Co.

SHERMAN CORNELIUS SCHAUER

consolidated with the Bickford Drill and Tool Co. under the name of the Cincinnati Bickford Tool Co., with August H. Tuechter, president; Sherman C. Schauer, vice president and general manager; George P. Gradolf, secretary and treasurer, and H. M. Norris, mechanical engineer.

Mr. Schauer was a member of Vattier Lodge, No. 386, A. F. & A. M., and of the Cincinnati Business Men's Club.

He married Mary Lena Snipper at Hamilton, Ohio., Jan. 22, 1883. They had five children, all of whom are living.

Research Council Wants Information

The Engineering Foundation and the National Research Council are coöperating in compiling information about the research laboratories of the country and in promoting industrial research. The purpose is to aid the Government and the industries in war work and to further the welfare of the world through the advancement of American industry, engineering and science. To do this they request all laboratories that have not yet done so to send to the New York office a brief statement covering the following: Equipment—Not a detailed list, but a summary indicating kinds and capacities in a general way and mentioning apparatus of unusual character or size. Research work—General kinds, with reference, if permissible, to special problems which would indicate the scope of the work the laboratory can undertake. Staff—Classes, such as chemists, physicists, engineers and assistants; number of each; name of person in charge. Research time—All, half, one-third, or other approximation.

War Sparks from Industry's Forge

Edited by E. C. Porter

B. M. Baruch, chairman of the War Industries Board, stated that the demands from General Pershing for iron and steel were on the increase constantly. Every time an advance is made by the American Expeditionary Forces, said Mr. Baruch, there comes an order for more steel rails. The railroad builders with the army in France are keeping right up with the fighting forces.

* * *

Lieut.-Col. Barrett Andrews of the United States Motor Transportation Division, in his address before the truck owners' conference held in Detroit recently, said that 40,000 trucks, 7900 passenger cars, 24,250 motorcycles and 6500 ambulances were being used by our first American Field Army in Europe for transportation work and that these vehicles alone required the attention of 154,000 men.

* * *

Drill chucks and electrolytic cells have been added to the export conservation list by the War Trade Board and will require individual licenses for exportation. The restrictions upon the importation of grindstones have been modified by the War Trade Board, which will now allow the importation of grindstones from Europe and Mediterranean Africa when coming as a return cargo shipped from convenient ports and when loading can be done without delay.

* * *

The mail service for our army abroad has now been taken over by the Army. It is handling a million letters a day that are received in France from this country, and about 300,000 letters a day that are mailed in France for soldiers in France. It has warehouses for sorting mail at French ports. It has railway mail clerks on some 2000 miles of French railroads. It has a central post office at Tours, permanent post offices at various points, mobile post offices right up to the firing lines and mail orderlies attached to each company of troops.

* * *

Brig.-Gen. Daniel McRoberts, head of the Procurement Division of the Ordnance Department, has returned to Washington from a two-months' tour of inspection in England and France. General McRoberts says that the Browning gun is now being delivered in quantity to American forces in France, and that thus far has successfully met the various tests imposed upon it by the British and French governments, which have asked that any surplus number be made available for use by the British and French armies. Regarding the U. S. model 1917 rifle being made for the American soldiers he said that it has won the hearty indorsement of our soldiers who have tried it out in battle. It is proving to be an all-round practical weapon for actual fighting, and the soldiers are enthusiastic over its performance. On his return trip General McRoberts flew from Paris to London in an airship.

The Army Ordnance Department announces that production of small-arms ammunition (cartridges for machine guns, rifles, revolvers and pistols) has passed the three-billion mark. A grand total of 3,054,160,110 cartridges had been accepted by ordnance inspectors on Oct. 11. Of this number 2,510,628,510 are service ball cartridges for machine guns and rifles, and 275,524,200 are 45-caliber pistol and revolver cartridges. The remainder are miscellaneous cartridges, many being types specially adapted for use in airplanes (such as tracer, incendiary and armor-piercing cartridges) and a limited number for training purpose.

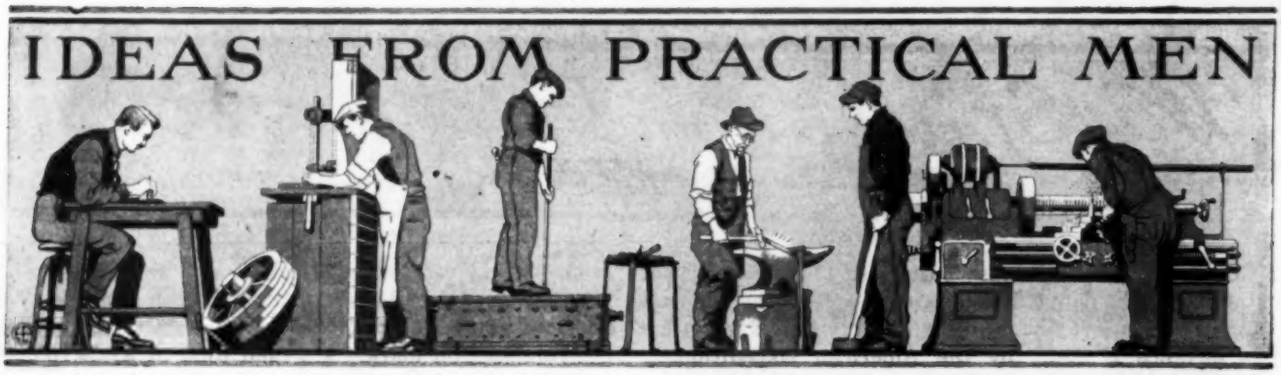
* * *

General Pershing expects that work in the Eddystone rifle plant of the Midvale Steel and Ordnance Co. at Eddystone, Penn., will keep production going in the coming months in such a way as to deserve the thanks of himself and the whole American Expeditionary Forces. Replying to the recent pledge made by 14,000 employees and workers of the plant to earnest, regular and steadfast work, which was sent him through Brig.-Gen. J. T. Thompson, Director of Arsenals, General Pershing has sent the following cable: "The American Expeditionary Forces send thanks to the employees of the Eddystone rifle plant for their message. We thank you for what you have done, for what you are now doing, but most of all for what you are going to do during the coming months.—PERSHING."

* * *

Maj.-Gen. C. C. Williams, Chief of Ordnance, has written the Single Service Package Corporation of New York commending the employees of that plant for having attained a production speed of more than 100 hand grenades a minute. The grenade being turned out by this company is the "offensive type" being employed by infantry organizations when making an attack to clean up the enemy's trenches and other defense systems. While the production at this and other plants was in the midst of the speeding-up process enemy influences in this country began spreading reports that the offensive hand grenade was not effective and that persons employed on manufacturing them were wasting their efforts. General Williams, in his letter to the company named above, takes occasion to deny this. The third million of grenades made by this concern was shipped to France the middle of last month, having been produced in exactly one month's time. Recently the plant shipped more than 300,000, or 55,000 a day, Saturday being counted as four-ninths of a day, this despite the plant was closed down ahead of time one day to permit its employees to register under the selective-service draft act. The maximum production was attained Friday, Sept. 13, when 55,200 grenades were turned out. Simple as it appears when completed it requires 25 distinct operations to make a grenade.

IDEAS FROM PRACTICAL MEN

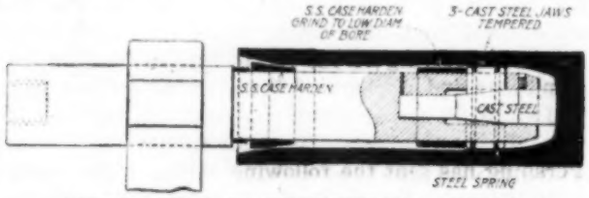


Special Chuck for Holding Shells to Be Recentered

By A. F. White

A quick-acting device designed to be used in a small lathe for the purpose of recentering shells is here illustrated. It operates very smoothly and performs its functions as well and as quickly as the air-operated chuck that is usually used for this purpose and which is much more expensive to build.

The device screws onto the spindle nose of the lathe in the usual way. At the outer end three equally



DEVICE USED IN RECENTERING SHELLS

spaced jaws operated by a taper plug grip the interior of the shell and hold it against the light cutting pressures necessary to this operation.

The taper plug is fitted to slide easily in a hole bored axially in the body of the tool and is held from coming out by a setscrew fitting into a flatted-off portion of the plug. The inner ends of the jaws conform to the shape of the tapered portion of the plug. Spring snap rings serve to hold the jaws from coming out and assist in releasing the grip when the shell is withdrawn.

A floating ring tapered on its outer circumference and backed by a light coil spring serves to center the open end of the shell.

Altering the Shape of a Formed Cutter

By Gustav Kopsch

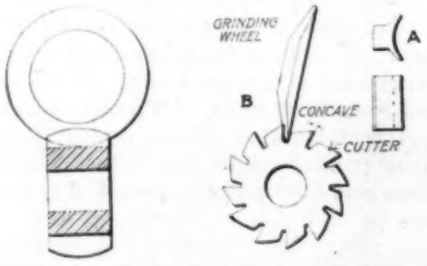
Some time ago I was in charge of the tool developing of a factory that was building a large number of small motors and dynamos of interchangeable type. It was decided to change the diameter of the armatures slightly, which necessitated a small increase of the radius of the polepieces. These polepieces were made in great quantities from drop-forgings, and the inside curve was milled in a gang-milling fixture, two rows of polepieces being milled simultaneously by two cutters. The polepieces had approximately the shape shown at *A* in the sketch.

The milling cutters were high-speed-steel form-cutter type, to be sharpened on the face of the teeth so as to retain the correct shape indefinitely. It was practically impossible to grind the teeth to the new curve, as this would have meant grinding two spherical surfaces; on the other hand replacing a few sets of such cutters would have caused loss and delay in production. The following method was employed which worked out very satisfactorily:

The faces of the teeth were ground slightly concave by using a dished wheel exactly above the center of the cutter so that the wheel is lowered and raised but not passed back and forth in the direction of the axis of the arbor on which the cutter is held. After once establishing the curve needed for the face of the teeth the cutters were ground as readily and in about the same length of time as by the ordinary method. The sketch shows at *B* perhaps more clearly what I mean than a lengthy explanation could do.

In a few hours everything was moving along as smoothly as before, a few hundred dollars' worth of cutters were saved, and the tool sharpener experienced no difficulty in resharpening the cutters to the correct shape.

I believe that in certain cases where a radius has to be milled which differs slightly from a standard size



THE WORK AND THE METHOD OF GRINDING THE CUTTERS

a standard radius cutter may be used and ground concave in this way. Of course the new curve is not a perfect arc, but rather the resultant of two intersecting spheres. The error is, however, so small that in this case it could not be detected by the closest inspection.

Jig to Mill Cam Slots

By Christian F. Meyer

The illustration, Fig. 1, shows three cams *A*, *B* and *C*, each made in halves, and one-half of each cam provided with one or more slots into which are fitted small cast-iron bits. The purpose of these bits is not only

to provide for readjustment at the point of greatest wear but also to make such slight alterations in curvature as may be necessary to adapt the machine, of which they form a part, for different classes of work.

The bits are adjusted by a screw which works in the square cored hole and are held in the cam by a collar-head screw fitting in a slot in the bit. The arrangement is clearly shown in the section.

The cutting of the slots has heretofore been done in two operations, being first milled radially, after which the cam was reset and the slot milled across its working surface, these operations being repeated for each slot. It was difficult to cut the depth of all slots exactly alike, which is essential, as the bits must be interchangeable, and it was also necessary to employ a skilled mechanic to lay out the slots, as their position is very important. All this and the many settings and cuts necessary made the operation a slow and costly one.

The jig here described cuts all slots in any cam in one setting regardless of its shape. It also takes care of the depth of the cut and its proper location and the work can be quickly and accurately done by anyone.

Fig. 2 shows the jig as it is used to mill the slots of cam *A*, Fig. 1. The jig can be quickly and easily adjusted for the various cams by the simple exchange of a locating plate which will be more fully described.

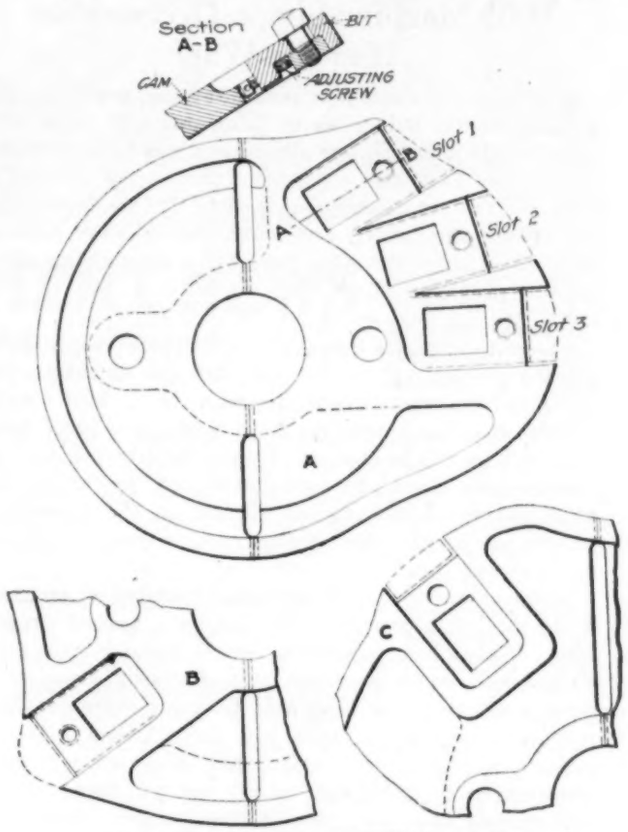


FIG. 1. CAMS WITH RENEWABLE BITS

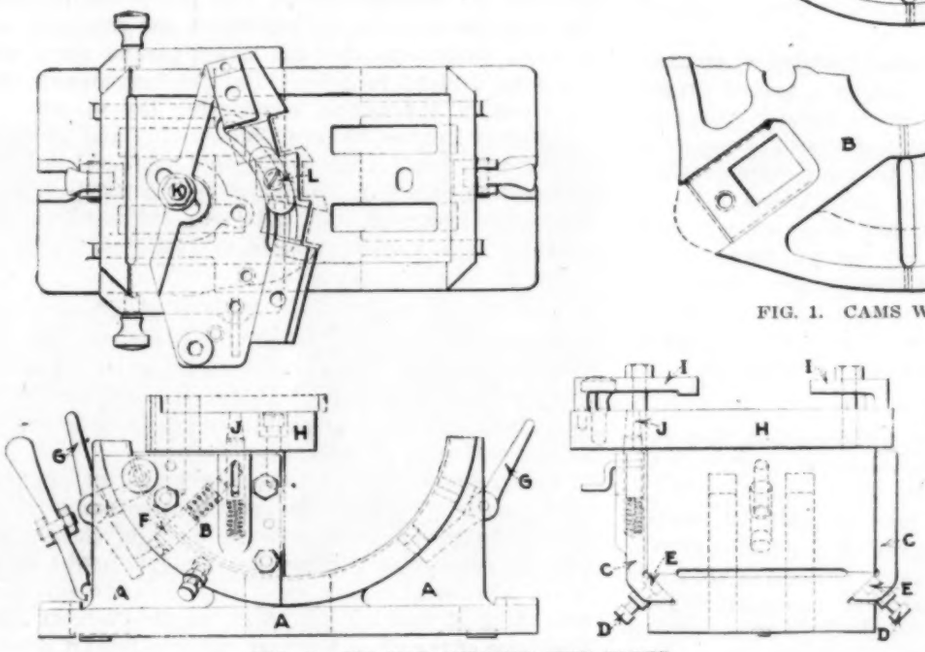


FIG. 2. JIG FOR MILLING THE SLOTS

The jig consists of a base *A*, Fig. 2, the upper part of which is finished in the form of a semicircle. A block *B* is arranged to slide on this circle and is held against lateral movement by two guide plates *C*, and can be clamped firmly in any position by the screws *D* bearing upon the gibs *E*, these gibs being held in place by small pins not shown.

A spring-actuated locking pin *F* serves to hold the block in either of two positions at right angles to each other. The blocks can be unlocked from either position by the handles *G*.

The cam is fastened to a locating plate *H* by means of clamps *I*. The locating plate *H* can be swung around in a curve which is determined by the shape of two slots in the plate, and is locked in any one of three positions by the hardened-steel locking pin *J* located in one of the guide plates.

Let us assume that slot No. 1 of *A*, Fig. 1, is to be cut. Pin *J*, Fig. 2, has located the plate and the latter is secured in position on the block by the screws *K* and *L*, the latter being easily reached through the square-cored hole in the cam. The cutter is now set to cut the proper depth of the radial slot by means of a gage placed on the plate. The automatic stop of the milling machine is set to stop the cutter when the required length of slot is reached. Slot No. 2 is cut in the same manner. The block *B* is now set in its second position, bringing the work at right angles to the first position. The plate *H* is then passed through the same steps as when in the first position and the slots across the working surface of the cam are cut to correspond with the radial slots. The slots about which the plate *H* moves are arranged in such a manner as to bring each slot of the cam in correct cutting position; thus any number of these cams can be cut quickly and absolutely alike.

For other shapes of cams it is necessary only to replace plate *H* with a similar plate calculated and made in the proper form to suit the work that it is desired to produce.

EDITORIALS

Will Machine Shops Decentralize After the War?

ALTHOUGH there is a general agreement that nothing should induce us to relax our war work even for a single moment, nor allow ourselves to be diverted in any way from the winning of the war, a number of men who are not directly engaged in this work are looking toward the future, and it may be well for more of us occasionally to devote a thought to some of the after-the-war problems.

* * *

There can be no question as to there being many serious problems in connection with the reconstruction period which must follow the war. It is also equally obvious that the transition from a war to a peace basis must not be left to chance. Comprehensive plans of reconstruction should be formulated and, so far as possible, perfected in every detail, for in the manner in which we handle this reconstruction period depends much of our future prosperity.

Some of our institutions have expanded at an enormous rate, this occasionally reaching a tenfold proportion. Wages have advanced almost beyond belief, and as a result many workmen who formerly eked out a mere existence have been able to enjoy some comforts and even luxuries. Those who have looked into this matter carefully feel certain that workmen who have experienced an enjoyment of life are not going to consent quietly to a reduction of their wages unless there are compensations in the way of reduced costs of living. An era of high costs cannot exist together with one of low wages without causing serious disturbances.

* * *

A solution for some of our problems has been proposed by C. C. McChord of Kentucky, a member of the Interstate Commerce Commission, a member of the Railroad Wage Commission, and in addition recently appointed as one of the umpires of the National War Labor Board. Mr. McChord says: "What is needed in this country is a wider diffusion of manufacturing industries and the local supply of the necessaries of life. Products of our factories are distributed throughout the land, but often under circumstances of such economic waste as to demand a radical change. In the development of manufacturing many elements have conspired to confine factories to limited territories or particular cities.

"The attempt to build up industries over scattered districts has not been entirely successful in the past owing to a number of reasons. And in the 20 years from 1875 to 1895 the whole Middle West made strenuous efforts to obtain manufacturing industries of various kinds. During that period, by the payment of large bonuses, offers of free taxes, coal and water, and in other ways, some sections secured the location of factories that gave promise of affording cheap material for home consumption and a distribution of the surplus to neighboring towns. Many of these factories failed, and a ride over the country today will disclose crumbling buildings and smokestacks in numerous towns and villages as grim monuments of the dead hopes of their promoters.

"The reason for these failures was the fact that railroads favored certain manufacturing centers in the way of facilities and rates. It seems to be conceded by everyone that no matter what is done in respect to the great transportation systems of the country after the war is over, certain condemned practices and the unbridled competition of past years is at an end, and that by some means the carriers of the future will be under such regulations as will insure the largest and most effective use of the facilities they have for the conduct of the transportation business of the land without favor to one shipper or prejudice to another.

"The most important matter just now, however, is the part that the railroads should play in the readjustment that must be made in our industrial and economic conditions. As before noted the larger part of our manufacturing is done in cities. The greatest manufacturing cities of the nation, considering the variety and quantity of production, are Chicago, Ill., and Philadelphia, Penn. Southern New England has developed into a succession of manufacturing cities. Pittsburgh dominates the iron and steel industry; it controls prices wherever sales may be made in this country."

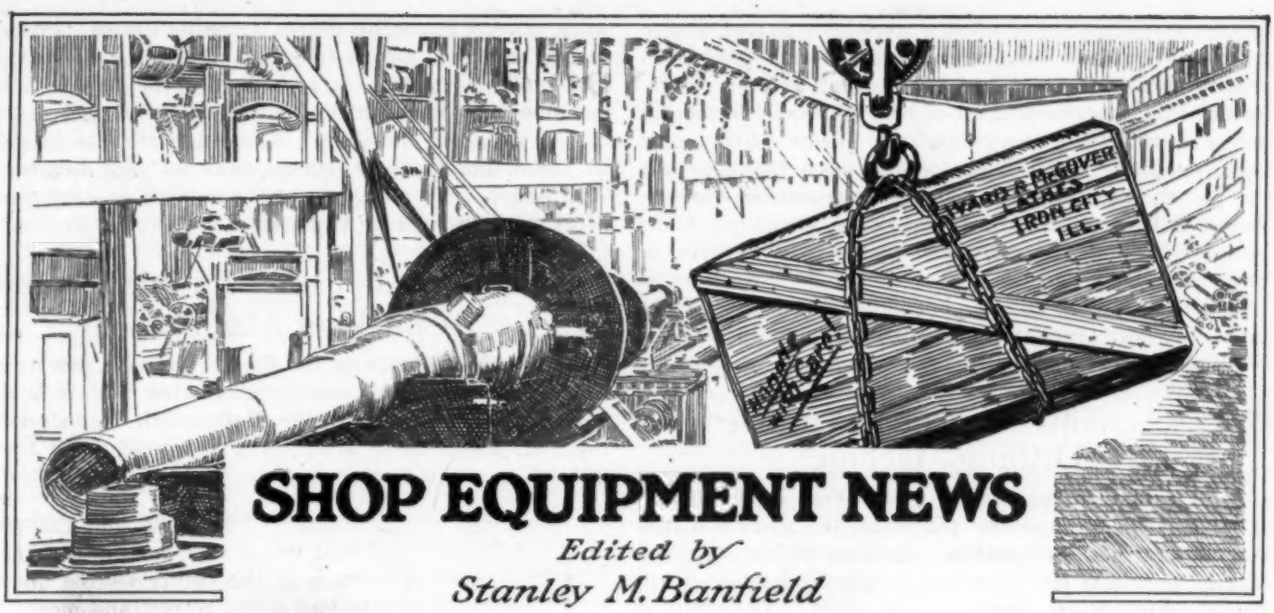
* * *

It is the belief of Mr. McChord that railway transportation will be so controlled that industries need not congregate in the large centers, and that this diversion will add much to securing better economic opportunities for all and will add to the ultimate greatness of the nation as well as to individual contentment.

Such a distribution of industries would tend to build up a series of small cities probably adjacent to our present large industrial centers. Some of these might even be reduced in the process, and we might expect to see territorial expansion of city limits to suit those who think in nothing but terms of the "largest city." The name of the place, however, matters little if a better distribution of shops and better living conditions can be realized and the congestion in city transportation which now exists reduced.

* * *

How will a redistribution of manufacturing centers affect the machine-building industries? Many of them are already located in small towns and villages and seem o find it no particular disadvantage. Some of the most successful in fact are not even well located as to railroad facilities. There is no doubt that equality in railroad rates and in railroad services would do much to allow builders of machinery locating in the less crowded centers. Whether this would necessitate a sales office in the city is another matter.

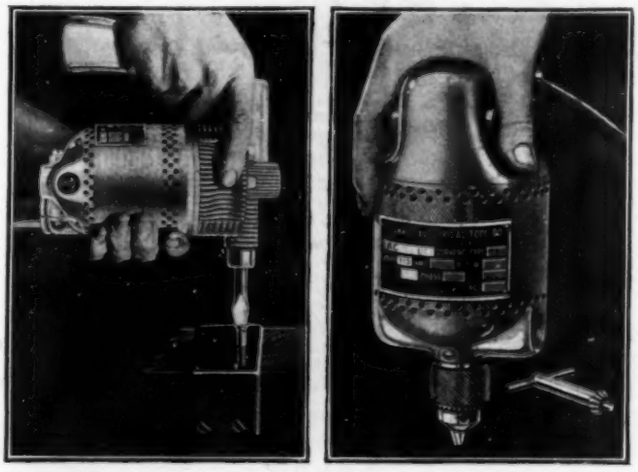


SHOP EQUIPMENT NEWS

Edited by
Stanley M. Banfield

McKay Motor-Driven Screwdriver and Airplane Drill

George C. McKay, 4247 Greenlee Ave., Cincinnati, Ohio, is now marketing the motor-driven tools shown in the illustrations. Fig. 1 shows the screwdriver, while Fig. 2 shows the drill. The screwdriver weighs but 5 lb., but it is claimed that it will drive any screw



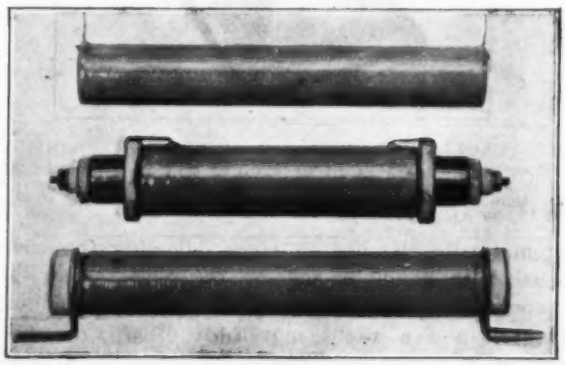
FIGS. 1 AND 2. AUTOMATIC ELECTRIC SCREWDRIVER AND AIRPLANE DRILL

that can be driven with a hand brace. It is equipped with an automatic burn-out protection device that shuts off the current mechanically when the machine is overloaded either by accident or through carelessness. The device operates entirely by direct overload on the spindle and there are no fuses to be burned out or replaced. After the motor has been stopped it is simply necessary to pull out the switch button and push it in again when the motor will again start. The device is entirely inside of the machine where it is not apt to be tampered with. On the machine shown in the illustration is a handle which covers one of the spindles, but this is held in place by two screws and can be easily removed in case it is desired to use the other spindle which revolves in the opposite direction. If it is more convenient the machine can be used without the handle when both the right and left hand spindles are ready for instant use. The spindles run at 250 r.p.m., but are stationary except when the machine is in use, pressure on the top of the screw engaging a positive driving clutch. The motor runs at 10,000 r.p.m., the speed being reduced through a worm and worm-wheel. The bearings on the armature and gear shafts are of the ball type, and the motor is cooled by means of a fan machined from a bronze casting.

The airplane drill shown in Fig. 2 weighs 3½ lb. and will drill holes in brass or aluminum up to ½ in. diameter and in wood up to ¾ in. in diameter. The motor runs at 10,000 r.p.m., and will operate on either alternating or direct current. The ¼-in. chuck is screwed directly to the armature shaft and the operating switch is located in a convenient position.

General Electric Enameled Resistance Units for Current Regulation

The resistance units shown in the illustration are a few of the various forms and sizes now manufactured by the General Electric Co., Schenectady, N. Y., for cur-



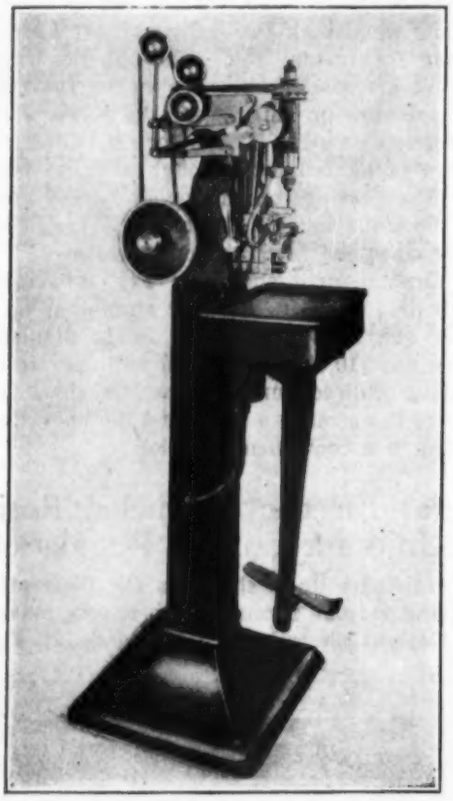
GENERAL ELECTRIC ENAMELED RESISTANCE UNITS

rent regulation. The units have been particularly designed to withstand high temperatures and sudden changes of temperature. The resistance wire or con-

ductor is wound either upon a steel body coated with a special refractory enamel or paint or on a high-heat-resisting silicate compound. The steel body is recommended for extreme lengths or where vibration or shock are present, while the refractory silicate body is for ordinary use. After being wound upon the body the conductor is embedded in blue vitreous enamel which is fused until it has a uniform glossy structure. The enamel is moisture and heat resisting and forms a mechanically strong casing for the conductor. Several different methods of attachment to the circuit have been provided for, the units being made in various sizes and capacities.

Caulkins-Carpenter Sensitive Drilling Machine

The Caulkins-Carpenter Co., 564 West Randolph St., Chicago, Ill., has recently placed on the market a new high-speed sensitive drilling machine which has been designed to save the time that is usually lost in clamping, removing and feeding small parts. The work is



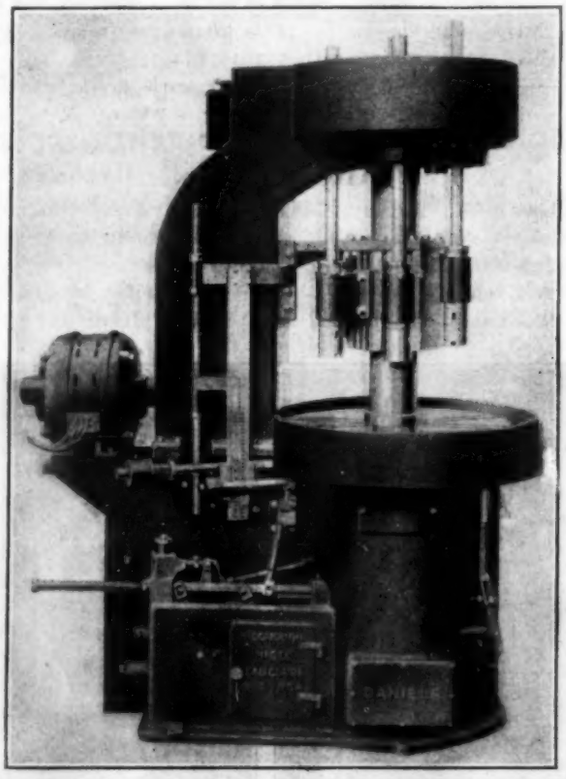
CAULKINS-CARPENTER DRILLING MACHINE

Capacity, up to $\frac{7}{8}$ in. in work up to 1 in. in diameter; weight, 350 lb.; bearings, ball type; width of V-belt, 1¼ in.; speed ratio, 750, 1000, 1250, 1500, 2000, 2500, 3000, 4000, 5000, 6000, 8000 and 10,000 r.p.m.

automatically clamped in place, allowing the operator to use both hands in feeding the parts. The spindle is operated by a foot lever at the right side of the machine, and a slight movement of this clamps the work while a continued movement feeds the drill to the work. When the proper depth has been reached, the spindle is automatically tripped and returned to neutral position and the work is ejected, when a new piece can be quickly fed. Some of the special features of the machine are the automatic quick return of the spindle, work ejector, clamping device, tripping device, belt adjuster and the cutting-lubricant system. A positive pump for lubrication is provided in the base of the machine, and oil or drilling compound is forced direct to the point of the drill. A spring collet is located in the hollow spindle which runs on ball bearings. A two-step cone pulley for a 1¼-in. belt is used, this being of linen with a V-shape.

"Daniels" Automatic Multiple-Spindle Chucking Machine

The machine shown in the illustration is a new automatic multiple-spindle chucking machine that is being placed on the market by the McDonough Manufacturing Co., Eau Claire, Wis. It will handle work from 3 to 6 in. in diameter and perform such operations



"DANIELS" AUTOMATIC MULTIPLE-SPINDLE CHUCKING MACHINE

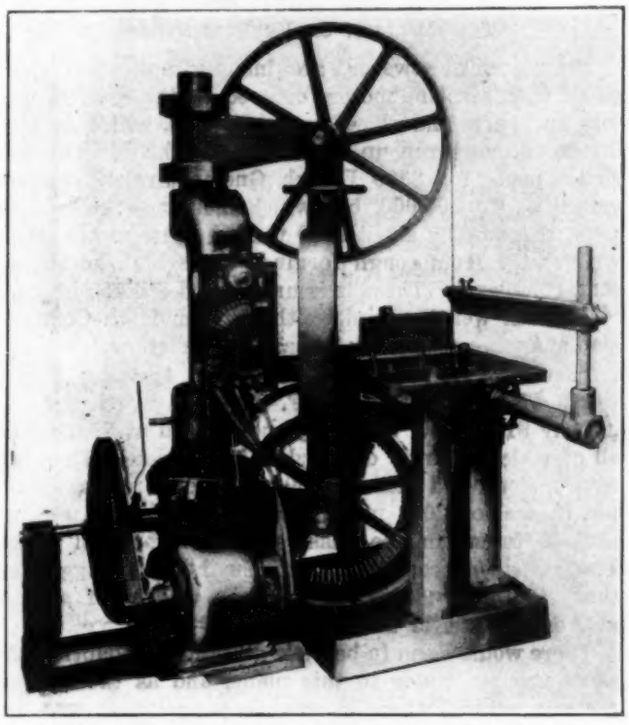
Capacity, work from 3 to 6 in. diameter; tool-carrying spindles, 5; diameter of table, 36 in.; diameter of chucks accommodated, 10 in.; travel of spindle carrier, 13 in.

as cup turning, drilling, boring, reaming, facing, tapping with collapsible taps and drilling multiple offset holes by means of multiple-spindle auxiliary heads fitted to the spindles. The machine has five tool-carrying spindles and a blank station. The turret upon which the spindles are mounted and the axis of which is concentric with that of the table does not revolve, but feeds the tools to the work through its automatically controlled vertical movement. The table has six chucking positions, one station being the point at which work is removed and loaded. The spindles have a rapid approach and a rapid reverse from the work, the spindle carrier being operated by means of a quadruple screw in a bronze nut in the center column. The screw is

revolved by a worm gear and worm and three friction clutches, one for rapid approach, one for feed and one for rapid reverse. The friction clutches also furnish the means for protection should a tool break or jam in the work. The table is 36 in. in diameter and six 10-in. chucks, or work holders, can be mounted. The travel of spindle is 13 in., 4 in. of this movement being required to withdraw the locating pin and control the indexing of the table. The table can also be set to index one, two or three spaces, depending upon the operations required. The speeds are varied by means of change gears, and each individual spindle is also provided with change gears in order that it may be set to the most advantageous speed.

Atkins Metal Band-Saw

The metal band-saw machine shown in the illustration is one of the late products of E. C. Atkins & Co., Inc., Indianapolis, Ind., and is known as the company's No. 3. It is claimed that this machine will average from two to three times as much work as any hacksaw machine on the market and that it will at least equal



ATKINS NO. 3 BAND-SAW MACHINE

if not beat the rapidity of cutting of a circular saw. It is claimed that the cost of blades is considerably less than that for milling cutters. Another advantage is that the thickness of the band-saw is only about $\frac{1}{32}$ in., which is about one-half the thickness of a hacksaw blade and from $\frac{1}{4}$ to $\frac{1}{8}$ the thickness of metal-milling saw blades. Where large amounts of work are being done it is a feature that saves considerable metal. It is said that the machine will make a cut 4 in. across to within 0.010 in. of accuracy and that many of the cuts are more accurate than this. The feed is by gravity. The weight is concealed in the hollow-column leg and connected by a chain to the guide and saw arm through a rack-and-pinion movement. The saw blade runs vertically and travels in a straight plane up to the capacity of the machine. A positive automatic stop is connected with the movable vise jaw, which stops the machine as soon as the teeth have passed through the work, a feature that is said to overcome the danger of blade breakage. The band-wheels are supported by arms hinged to the main column and are held in place by a tension bar of a bowed design, making a strong, slightly elastic construction by which the stretch of the saw blade is automatically compensated for. The side of the tension bar is equipped with a gage to indicate the correct tension of the blade. Vise jaws may be adjusted to any desired angle up to 45 deg. and may be quickly removed in case it is desired to clamp irregular work by means of T-head bolts. The construction of the guides both above and below the table is such that adjustment may be made while the saw is running. The table is made in two parts and hinged at one end so that it can be swung back to enable the operator to clean out, repair or adjust any working part of the machine. This is also convenient in changing saws. It is recommended that the machine be run without cutting compound for most kinds of work, but where metals such as aluminum, brass, copper or certain vanadium steels are operated upon cutting compound is of course necessary. The lower band-wheel dips into a pan in the base of the machine, and this provides for the circulation of cutting compound when this is being used. The machine is furnished for either belt or motor drive as desired.

Meeting of National Machine-Tool Builders Postponed

On account of the epidemic of influenza the annual meeting of the National Machine Tool Builders' Association scheduled for Nov. 7-8 at the Hotel Astor, New York, is indefinitely postponed. It is hoped that this may be held later, due notice of which will be given at the proper time.

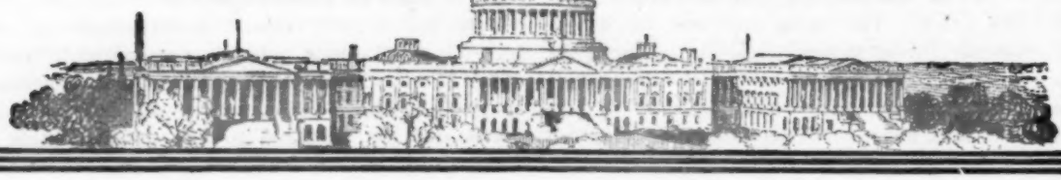
Engineers Needed for Construction Division of the Army

The Construction Division of the Army is in urgent need of 50 chiefs of survey party at $2700 to $3000 a year; 50 transitmen at $2400 a year; 25 levelmen at $2100 a year; 125 rodmen at $1800 a year; 150 chainmen at $1800 a year and 50 topographic draftsmen at $2100 a year. These positions are open to men only, except the drafting positions, which are open to both men and women. All the positions are in the civil service.

Those interested should apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the local board of civil service examiners at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle or San Francisco.

Applicants will not be required to undergo a written examination, the examination being of the "nonassembled" type; that is, the ratings will be based upon education, training, experience and physical ability as shown by the applications and corroborative evidence. These positions offer an excellent opportunity for patriotic service.

LATEST ADVICES FROM OUR WASHINGTON EDITOR



Washington, D. C., Oct. 26, 1918—Although Russia is still in a chaotic state there are occasional opportunities for doing business with that country, and those who have trade connections there will be interested to know that the War Trade Board will now receive and consider applications for the export of commodities to Russia. The board also announces that a limited amount of cargo space may be available for direct shipment from the Pacific Coast to Vladivostok. To facilitate the consideration of applications exporters are requested to state on each application whether or not the material is already made up and ready for shipment and, if so, where it is located.

Millions in Surplus Supplies

The Division of Military Aeronautics, it appears, desires to do a thorough job of housecleaning, judging by a statement recently given out, which goes into considerable detail over the unnecessary and in some cases wasteful expenditures which run high into the millions of dollars. These disclosures must be particularly interesting to Regular Army men who have so many times been accused of unbusinesslike methods, for it should be remembered that practically the entire handling of the aircraft program was in the hands of civilians who had reputations of being keen business men and "captains of industry."

Quoting from the statement of the War Department we find "the Division of Military Aeronautics has turned up since Aug. 6 a surplus of supplies worth $10,000,000 and its examiners have not yet finished their task. The supplies already listed include typewriters, motor cars, motor trucks, oil, lumber, wood, iron and steel working machines, motorcycles, building material, airplanes and about everything in the accessory line from screw eyes to stove bolts.

"This material has been unearthed by what is known as the Surplus Inactive Supplies Service, Purchase and Storage Branch, Purchase Storage and Traffic Division of the General Staff. This system has branches in almost all bureaus of the War Department with the commendable object of utilizing duplicate supplies purchased through the unavoidable lack of organization in the emergency and rush at the beginning of the war. These surplus supplies are listed as fast as they are found and put to use in some branch of the department or sold in the public market."

Some idea of the lack of organization—which is supposed to be the strong point of the modern business man—can be obtained from the fact that this inquiry has unearthed 417 typewriters valued at $25,000, 150,000 gal. of oil worth $75,000, 200 tons of hay valued at $3000, 9000 gal. of wing dope valued at $47,500, seven carloads of iron, steel and wood-working machinery found in a supply depot at Hampton, Va., 150,000 dry batteries, 500 pairs of field glasses (which are so scarce that people are being asked to donate their private glasses to the Navy) and 4,500,000 ft. of ⅜-in. rope.

Ten Million of French Scrap

These items, however, are insignificant when compared with airplane motors ordered by the French, motors and parts and planes ordered by us, which according to estimate run up to about $22,000,000. This includes parts for 3500 French Gnome airplane motors valued at $10,500,000, but which must now be sold as junk, there being about 2000 tons of these motor parts which vary from rough forgings to as high as 90 per cent. completed. These it is understood are 150-hp. motors which were ordered by the French High Commission and will presumably be paid for sometime.

There are also listed 300 Penguin training planes worth $750,000, 128 L. W. F. airplanes worth approximately $1,437,000, 1500 airplanes valued at $9,000,000, all of which are now declared to be obsolete. These all have motors, and there are 500 additional motors, making a total of 2000 motors which it is hoped may be utilized in submarine chasers and coast-patrol boats. The statement concludes with the hopeful suggestion that "the 1500 planes may also be utilized if a suitable engine is ever developed for it."

There would seem to be little difficulty in adapting the small Curtiss motor to this plane, and as the Curtiss factory, which manufactures these engines, was recently obliged to reduce its force because of lack of orders it might be possible to put these 1500 training planes into service if there is any need for them. With the acknowledged emergency for planes and motors the laying off of men in the oldest airplane-motor shop in the United States is not easy to understand.

A New Shop Problem

While we must of course devote at least 99 per cent. of our thought and time to the actual production of munitions it will be a good plan while we are resting to consider carefully what will no doubt be our first after-the-war problem. In fact the question is likely to be urged upon us before the war is over. I refer to the utilization of more or less crippled men who have already begun to come back.

It is generally understood that the Government plans to do all that it can in the way of restoration by surgical means and also to lay a good foundation for the training of these men before they are discharged from the service. This is as it should be, for it would be a lasting disgrace if any of those who have become crippled while fighting for us over there should not be provided with the means and the opportunity of making a living without the semblance of charity of any kind.

Work is already under way in a number of industrial centers for training men who have been deprived of various portions of their anatomy, but we must not be content to have this done perfunctorily, because its main object would be defeated. One-armed men and even those who have lost both hands can be taught to do many kinds of useful work, but the matter does not end here.

The expert toolmaker or draftsman who has become crippled in the service of his country can hardly be expected to remain contented at such occupations as caning chairs and operating a typewriter, for while both are highly useful and respectable we must not forget the natural tendencies and the previous training of the toolmaker and draftsman, and also consider the desire of the individual and the loss to the country by failing to avail ourselves of the time and money spent by these craftsmen in becoming expert at their original occupations.

Planning for Returned Men

Here is where one of the new problems of machine-shop management comes in. Every employment manager of the proper sort has already begun to study this question and to find occupations in the various departments of the shop in which men with previous training along these lines can be employed. Here is perhaps one of the best fields for careful motion-study and in some cases careful replanning of working methods to accommodate a certain number of crippled men in the different departments. Clearly it is the duty of every shop to employ its quota of returned soldiers who have become partially incapacitated in our behalf.

Care must be taken, however, to maintain a sane and normal attitude toward these men. Too much sympathy and coddling would have a bad effect. On the other hand, they must not be allowed to feel that they are objects of charity or that they are being particularly favored. By carefully selecting the work and in some cases altering machines and appliances or even to some extent changing the methods these men will be able to produce a good day's work, and they should be made to feel that they are earning all they receive. It is of course natural and proper that other men who for good reasons did not go into the Army should help these crippled men at times in such ways as handling heavy pieces, shifting belts and so forth, at the same time avoiding creating a feeling of dependency among the disabled which would interfere with their self-reliance, happiness and wellbeing. Then too there is always the danger of undermining a man's stamina by making him feel that he is dependent on others which produces a bad effect not only on the individual but on his production and on the community at large. This is a real problem for every shop manager and is one of the many by-products of the great war.

All who are considering employing returned soldiers should keep in mind that private industries cannot employ men who come in either of the first two classes except with the permission of the War and Navy departments. These departments will, however, gladly cooperate in all work of this kind.

Employers can coöperate with the labor departments of their own state or locality in making a systematic survey of the opportunities for disabled soldiers. Among other things such a survey will determine the number of places that can be filled and the kinds of work that can be done by men who are handicapped. In the state of Pennsylvania alone the Labor Department has listed 4200 places suitable for men with partial disabilities, and the list is not yet complete.

Training Schools

Machine industries which have regular training or vestibule schools will not find it difficult to alter some of their instruction work so as to cover the training of men who have lost fingers, hands, arms or legs. In one large industrial plant there are between 1500 and 2000 men at work who are minus some of the aforementioned members. It has found occupations for a few blind men, and also has between 3000 and 4000 men suffering from tuberculosis, hernia, rheumatism, etc., to whom they have given special attention and have assigned them to jobs that they can handle. After being placed in positions suited to their physical condition and given a few days' individual attention these men as a rule are able to produce practically as much as those who are physically sound.

This is one of the new problems that confront all manufacturers, and it is just as much a part of the war as making munitions or buying Liberty bonds.

The Effect of Health on Production

Spanish influenza has given us a striking example of the effect of health on production and shows clearly that it is no longer possible to consider the shop as being entirely independent from the home life of the workers or from the community. The epidemic has seriously interfered with war work in various parts of the country, and Washington is no exception, as many ordnance offices have been almost depleted.

If medical men are to be believed all epidemics of this kind could be largely prevented if systematic measures were taken at the outset in the shops, in the homes and by the community in general. Those who have been advocating health insurance, while not claiming that this means absolute immunity from disease any more than life insurance means perpetual longevity, point to the great decrease in industrial accidents since the passage of laws covering workmen's compensation. They claim on what appears to be excellent grounds that just as precautions have very largely prevented accidents precautions will likewise lessen such epidemics as the present one. Such a consummation would have a marked effect not only on the quantity of production but also on its cost. Every machine now idle, owing to its operator being incapacitated by influenza or by any other cause, adds to the overhead charges of a business, and this extra cost would in all probability far overbalance the cost of health insurance as in the case of accident compensation in the industries.

Personals

F. H. Lennox, for some time connected with the engineering department of the Transmission Ball Bearing Co., Buffalo, N. Y., has been promoted to sales engineer of that concern with headquarters in Buffalo. Mr. Lennox was formerly sales engineer of the Gurney Ball Bearing Co., Jamestown, N. Y. He will also take care of the advertising.

G. A. Davies has resigned as sales manager for Wickes Bros., Saginaw, Mich., and has established a machinery sales office of his own in Detroit, Mich.

F. D. Chriscaden is now sales manager of Wickes Bros., Saginaw, Mich.

B. H. Tripp has been appointed district manager of sales for the Pacific Coast territory of the Chicago Pneumatic Tool Co. of Massachusetts. He succeeds **M. W. Priscler.**

A. S. Heinrich, president and chief engineer of the A. S. Heinrich Corporation, Freeport, Long Island, N. Y., has had the name of the company changed to the Victor Aircraft Corporation.

Herbert A. Hansen is now chief draftsman of the C. L. Best Gas Traction Co., San Leandro, Calif. He was formerly connected with the purchasing department of the Holt Manufacturing Co., Peoria, Ill.

E. P. Cooke has assumed the duties of sales manager of the Fawcus Machine Co., with headquarters at the company's Pittsburgh office. Mr. Cooke still retains his interest in the Armstrong Cooke Steel Co., which he organised after leaving his engineering position with the Corn Products Co. of Chicago.

W. W. Coleman and **T. H. Symington** have been appointed special assistants to the Chief of Ordnance. Mr. Coleman will have charge of all matters connected with the production of cannon, carriages and their appurtenances. Mr. Coleman has been president of the Bucyrus Co., South Milwaukee, Wis., and has been with the Production Division of the Ordnance Department since last spring. Mr. Symington will have charge of artillery ammunition. He is a member of the firm of Symington-Anderson Co., Rochester, N. Y., iron and steel manufacturer.

W. D. Appel, at one time motor engineer of the Steel Products Co., Cleveland, Ohio, is now employed in the engineering department of the Curtiss Engineering Corporation, Garden City, Long Island, N. Y.

H. F. Peavy is now assistant engineer of the Mercer Automatic Co., Trenton, N. J. He was formerly engineer of the Locomobile Co. of America, Bridgeport, Conn.

T. M. Germane is now director of sales of the Standard Roller Bearing Co., Philadelphia, Penn. He was formerly the general manager of the company.

David T. Eighmey, formerly engineer of the Campbell Motor Car Co., Kingston, N. Y., is at present with the Wright-Martin Aircraft Corporation, Long Island City.

Charles G. Keller is now production engineer of the Savage Arms Corporation, Sharon, Penn. Mr. Keller was formerly engineer of the Robeson Cutlery Co., Perry, N. Y.

Henrik Gregor has taken a position as assistant engineer in the enginering section of the Division of Steel Ship Construction of the Emergency Fleet Corporation, Philadelphia, Penn. He was formerly with the Prescott Co., Menominee, Mich.

Frank G. Frost, formerly general superintendent of the Houston (Tex.) Lighting and Power Co., has become superintendent of power for the New Orleans Railway and Light Co., New Orleans, La.

Ralph Earl, formerly with Morris Knowles, Inc., Pittsburgh, Penn., as assistant engineer, is now with the Water Purification Board, Sewerage and Water Board, New Orleans, La.

Leland G. Knapp, formerly of the Harsh & Chapline Shoe Co., Milwaukee, Wis., as efficiency engineer, has taken a position with the Wisconsin Motor and Manufacturing Co. of the same city.

John B. Wilkinson is now connected with the Federal Dyestuff and Chemical Corporation, Kingsport, Tenn., as superintendent of heat, light and power. He was formerly draftsman with the Nordberg Manufacturing Co., East Milwaukee, Wis.

E. T. Spidy, formerly production engineer of the Canadian Ingersoll-Rand Co., Sherbrooke, Canada, has taken a similar position with the Canadian Pacific Railway Co., Angus Shops, Montreal, Canada.

Douglas K. Warner, efficiency engineer, New Departure Manufacturing Co., Burdett, N. Y., is now with the Sheffield Scientific School, Yale University, New Haven, Conn.

Jiles W. Haney is now assistant professor of mechanical engineering, University of Nebraska, Lincoln, Neb. He was at one time connected with the experimental engineering department of Pennsylvania State College, State College, Penn.

Grant E. Furbush has resigned his position as instructor in industrial engineering at Pennsylvania State College, State College, Penn., and is now mechanical engineer of the Fafnir Bearing Co., New Britain, Conn.

Business Items

Speakman Co. is the new name of the Speakman Supply and Pipe Co., Wilmington, Del. The change of name does not indicate any change in policy or officers.

The O. R. Adams Manufacturing Co., Rochester, N. Y., is erecting a new building for greater production of the Adams Short-Cut lathe.

Arthur Knapp Engineering Corporation has moved its executive offices to the Architects Building, Park Ave. at 40th St., New York.

The Geo. F. Foss Machinery and Supply Co.—We wish to correct a statement that appeared in the Sept. 26 issue of this magazine with reference to The Geo. F. Foss Machinery and Supply Co., of 30 Church St., New York, which is somewhat misleading. We are advised that this business is not a branch of The Geo. F. Foss Machinery and Supply Co., Limited, of Montreal, but is a separate and distinct concern. George F. Foss is sole proprietor of the New York business, and is also president of the Limited company in Montreal, which, by the way, was established about eight years ago and not 25 years, as previously stated.

The Amalgamated Machinery Corporation, Chicago, has purchased the steel foundry of the Heyward Steel Co., New Cumberland, W. Va. The property was only recently acquired by the Heyward Steel Co. The foundry has a 20-ton acid open-hearth furnace.

The Koppel Industrial Car and Equipment Co. is the name of the subsidiary of the Pressed Steel Car Co., which will take over the business of the Orenstein Arthur Koppel Co., builder of industrial cars and equipment, Koppel, Penn. The plant was recently sold to the Pressed Steel Car Co. by the Alien Property Custodian.

O. T. Webb, Milwaukee, dealer in new and used machine tools and shop equipment, has moved his offices and headquarters from 25 Mack Block to a new building at 224 Fourth St., where display and storage space is available. For 10 years he was vice president of the O. L. Packard Machinery Co., now the Badger-Packard Machinery Co., but for several years has conducted business on his own account. W. T. Reimer, formerly connected with the M. J. Walsh Machinery Co., 144 Sycamore St. and now an individual dealer in tools, will be associated with Mr. Webb.

R. F. Hayes has taken over the used-machinery department of the Charles H. Walker Machinery Co., Detroit, and will operate under the name of the Hayes Machinery Co., with headquarters at 42 East Larned St., Detroit.

Obituary

Harry H. Latham, Chicago, president of the Latham Machinery Co., died at his home Oct. 9 of influenza. Mr. Latham was born in Sandwich, Ill., 1859, was educated at Northwestern University, and in his early years practiced his profession as a civil engineer throughout the then wild West going to Chicago in 1884. He was president of the Latham Machinery Co. since its incorporation in 1894.

Eugene L. Steindler, president of the Arcwell Corporation, New York, died Oct. 2 of influenza at the age of 31 years. Mr. Steindler was the founder of the Arcwell Corporation, which was organized last May to manufacture a new electric alternating-current arc welder. He was also a director and general manager of the Dominion Reduction Co., Cobalt, Ontario, and the Blue Stone Mining and Smelting Co., of Colorado.

William P. Tuechter, president of the Century Machine Co., Cincinnati, maker of bakers' machinery, died at his residence in that city, Oct. 13, aged 42 years. He had been engaged in the manufacture of bakers' machinery for a number of years. He organized the Triumph Manufacturing Co., Cincinnati, Ohio, and later formed the company with which he was connected at the time of his death. A. H Tuechter, president of the Cincinnati Bickford Tool Co., is his brother.

John P. Hopkins, chairman of the board of directors of the Independent Pneumatic Tool Co., Chicago, Ill., and former Mayor of Chicago, died in Chicago on Oct. 13. He was ill only a few days and death was attributed to a weak heart superinduced by an attack of influenza. Mr. Hopkins was born in Buffalo, N. Y., in 1858. He moved to Chicago in 1880 and went to work in the Pullman Palace Car Co. as a machinist. Later he started in the general-merchandise business for himself as a partner in the firm of Secord & Hopkins, Pullman, Ill. In 1905 he became interested in the Independent Pneumatic Tool Co., and was a large stockholder in that company. He was one of its original organizers and was chairman of its board of directors at the time of his death.

Forthcoming Meetings

On account of influenza conditions the annual meeting of the National Machine Tool Builders' Association, scheduled for Nov. 7-8, at the Hotel Astor, New York, is indefinitely postponed. It is hoped that this may be held later, due notice of which will be given at the proper time.

The American Society of Mechanical Engineers will hold its annual meeting in New York, Dec. 3-6. The secretary is Colvin W. Rice, 29 West 39th St., New York.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

The National Founders' Association will hold its twenty-second annual convention at the Hotel Astor, New York, Nov. 13 and 14. The administrative council of the association will meet the day before and on the evening of that day will be held the dinner of the alumni composed of members of former administrative councils. The convention banquet will be held on Wednesday evening, Nov. 13.

New England Foundrymen's Association. Regular meeting, second Wednesday of each month. Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway Cambridgeport, Mass.

The New York State Industrial Safety Congress will hold its third annual session at the Hotel Onondaga, Syracuse, N. Y., Dec. 2-5. Particulars may be obtained from Louis Wiard, 230 Fifth Ave., New York.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadephia, Penn. Howard Evans, secretary, Pier 45 North Philadelphia, Penn.

Providence Engineering Society. Monthly meeting fourth Wednesday of each month. A. E. Thornley, corresponding secretary, P. O. Box 796. Providence, R. I.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Technical League of America. Regular meeting, second Friday of each month. Oscar S. Teale, secretary, 240 Broadway, New York City.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.

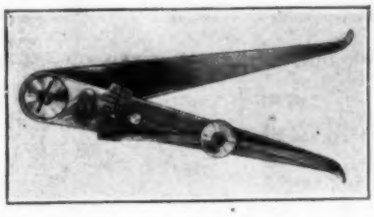
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Gage, Indicating

Grove Manufacturing Co., 440 Quitman St., Dayton, Ohio

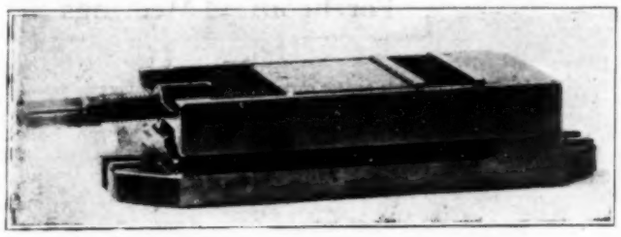
"American Machinist," Oct. 10, 1918



The device, although having some of the features of an ordinary caliper, is used in a slightly different manner. It is first set with a micrometer, like a pair of calipers, and the position of the indicating needle for the desired setting is noted. The device is then used on the work and the difference from the micrometer setting is indicated by the pointer. Hardened points are used and the joints are lapped to fit. The indicating pointer is held extended by means of the small spring shown and any difference in dimensions is magnified by means of lever arms if different lengths on the pointer.

Vise, Milling

Edlund Machinery Co., Cortland, N. Y.



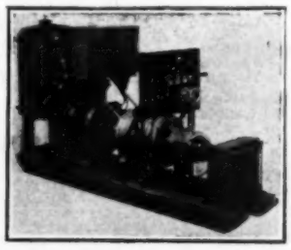
"American Machinist," Oct. 17, 1918

The advantage claimed is that the stationary jaw will remain square with the vise regardless of how much pressure is applied to the screw. The side bars operate a cam arrangement which moves the sliding jaw away from the work when the bars are raised and up to the work when the bars are lowered, the final clamping being done by means of the square-head screw. At present made in 4-, 5-, 6- and 7-in. sizes.

Arc-Welding Outfit, Portable Direct-Current

Lincoln Electric Co., Cleveland, Ohio

"American Machinist," Oct. 17, 1918

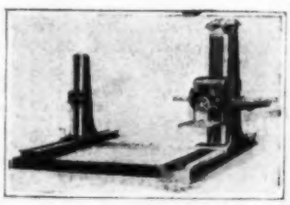


The outfit is portable for operation where electric current is not available and consists of a 150-amp. arc-welding generator direct connected to a Winton gasoline engine. A compound-wound generator is used, the series windings of which are connected to oppose the shunt field, the two windings being so proportioned that the voltage increases in the same ratio that the current increases, thus limiting the short-circuit current. It is claimed that this method of control gives considerably more work on a given amount of electricity than where the machines use the ballast resistance. Additional arc stability is insured by the stabilizer, this being a highly inductive low-resistance coil connected in the welding circuit and serving to correct momentary fluctuations of current.

Boring, Milling and Drilling Machine, No. 4

Giddings & Lewis Manufacturing Co., Fond du Lac, Wis.

"American Machinist," Oct. 24, 1918

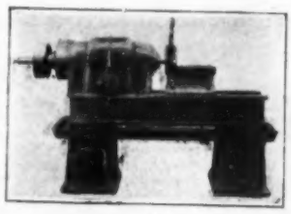


Diameter of spindle, 5 in.; continuous feed of spindle, 48 in.; size of hole in spindle, No. 6 Morse; maximum distance from spindle center to floor plate, 92 in.; minimum distance from spindle center to floor plate, 20 in.; size of floor plate, 8 x 12 ft.; maximum distance from face-plate to outer support, 124 in.; size of spindle sleeve front bearing, 7 in.; speeds, twelve, 4 to 160 r.p.m.; feeds without changing gears, sixteen, 0.0037 to 1.08 per spindle revolution; feeds on change gears supplied, forty-eight, 0.0007 to 5.4 in. per spindle revolution; vertical travel of head on column, 72 in.; horizontal travel of column on runway, 96 in.; height including motor, 13 ft. 4 in.; floor space, 16 ft. x 24 ft. 6 in.; weight, 38,000 lb.

Thread-Milling Machine, Planetary

Hall Gas Engine Co. Bridesburg Philadelphia, Penn.

"American Machinist," Oct. 17, 1918



The feature of the machine is that the milling cutter moves around inside of the work, which is held stationary at all times. It is claimed that this system not only makes for more accurate work but provides for greater speed in that the work and chuck do not have to be started and stopped. The accuracy of the machine is said to be increased by the fact that there are no sliding ways or table feeds to keep tight and that the rapid moving of heavy work in and out of the machine chuck cannot affect the accuracy of threading, as it is not on a movable table having feeds and adjustments. Made in two sizes, No. 1 having an internal threading capacity of 6 in. and a chuck capacity of 14 in., and No. 2 having an internal threading capacity of 12 in. and a swing over the bed of 24 in.

Burnishing Cones

Abbott Ball Co., Hartford, Conn.

"American Machinist," Oct. 17, 1918

These burnishing cones are intended for use in connection with burnishing balls for getting into small crevices or for figured work. These cones take the form of a flat disk with a small cone protruding from either side, and on account of this shape either the edge of the disk or the point of one of the cones will come in contact with the work and will reach into small sharp corners. The cones are about ¼ in. in diameter, the illustration showing them somewhat larger than they actually are.

Centering Machine

Middletown Firearms and Specialty Co., Middletown, Conn.

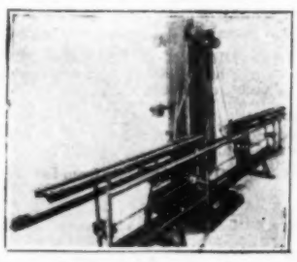
"American Machinist," Oct. 17, 1918

Designed to center round, square or octagonal stock, and it is claimed that it will do this operation to within one-thousandth of an inch of the true center in regard to the outside surface. Two speeds are provided, one for hard and one for soft stock, and a rest relieves the jaws of undue stress. An adjustment allows the machine to be set off center for doing work with eccentric centers. It will take round stock from $\frac{5}{8}$ in. to $3\frac{2}{4}$ in in diameter, and is provided with a stop so that all work is centered to a uniform depth.

Polishing Machine, Tube and Rod, Type A

Blevney Machine Co., Greenfield, Mass.

"American Machinist," Oct. 24, 1918



For polishing tubes, rods or other cylindrical parts whether they be made of metal, rubber, fiber or other such material. The automatic feed is taken care of by means of the feed roll shown in the center of the cut, and attached to the machine in such a way that it can be arranged to feed in either direction or may be adjusted so that the work is held stationary with regard to motion along its length. The framework for supporting the tube or rod is made up of standard steel shapes, and rollers are provided upon which the tube moves. Tubes of different diameters are accommodated by rocking the frame carrying the feed roll to and from the frame carrying the tube proper.

Patented August 20, 1918

WEEKLY PRICE GUIDE OF

IRON AND STEEL

The Government Schedule of steel prices went into effect Sept. 24. Pig iron was set at $33 per ton; pig iron differentials were announced by the American Iron and Steel Institute on Nov. 3. Washington announced sheet and pipe prices on Nov. 5. Warehouse prices have been revised, as shown, by agreement between the War Industries Board and the warehouses; new schedule in effect Nov. 15. Effective Apr. 1, the price of basic iron was fixed at $32, and standard Bessemer at $35.20 at Valley furnace, prices of other irons remaining the same as last quarter.

PIG IRON—Quotations compiled by the Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$37.60	$37.60
Northern Basic	34.80	34.80
Southern Ohio No. 2	35.80	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	39.55	39.15
Virginia No. 2	41.70	41.70
Southern No. 2	41.70	41.70
BIRMINGHAM		
No. 2 Foundry	34.00	34.00
PHILADELPHIA		
Eastern Pa. 2X	39.15	38.85*
Virginia No. 2	40.50	40.50†
Basic	36.90	36.60*
Grey Forge	36.90	36.60*
Bessemer	39.10	38.80*
CHICAGO		
No. 2 Foundry Local	34.50	34.50
No. 2 Foundry Southern	39.00	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	35.40	35.40
Basic	34.40	34.40
Bessemer	36.60	36.60

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.245	$4.245	$5.25	$4.17	$5.00	$4.27	$5.00
Soft steel bars	4.145	4.145	5.00	4.07	4.50	4.17	4.50
Soft steel bar shapes	4.145	4.145	5.00	4.17	4.50	4.17	4.50
Soft steel bands	4.745	4.995					
Plites, ¼ to 1 in. thick	4.495	4.495	10.00	4.42	7.00	4.25	9.00

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$4.75
Warehouse, New York	4.75	4.75
Warehouse, Cleveland	4.67	4.95
Warehouse, Chicago	4.10	4.50

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	New York				Cleveland		Chicago	
	Pittsburgh, Mill, in Carloads	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
*No. 28 black	5.00	6.495	6.495	9.50	6.42	8.50	6.52	9.25
*No. 26 bla	4.90	6.395	6.395	9.40	6.32	8.40	6.42	9.15
*Nos. 22 and 24 black	4.85	6.345	6.345	9.35	6.27	8.35	6.37	9.10
Nos. 18 and 20 black	4.80	6.295	6.295	9.30	6.22	8.30	6.32	9.05
No. 16 blue annealed	4.45	5.695	5.695	10.20	5.62	8.70	5.72	9.70
No. 14 blue annealed	4.35	5.595	5.595	10.10	5.52	8.60	5.62	9.60
No. 10 blue annealed	4.25	5.495	5.495	10.00	5.42	8.50	5.52	9.50
*No. 28 galvanized	6.25	7.745	7.745	11.00	7.67	10.00	7.77	10.50
*No. 26 galvanized	5.95	7.445	7.445	10.70	7.37	9.70	7.32	10.20
No. 24 galvanized	5.80	7.295	7.295	10.55	7.22	9.55	7.47	10.05

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 5c., all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 12%	List plus 25%
Cleveland	List plus 11%	List
Chicago	List plus 13%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price pr 100 lb., in ton lots is:

	Current	One Year Ago
New York	$15.50-19	$14.00
Cleveland	20.00	15.00
Chicago	19.00	13.50

In coils an advance of 50c. usually is charged.
Note—Stock very scarce generally.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire*		Cast-Iron Welding Rods	
1/16, 3/32, 1/8, 5/32, 3/16, 7/32, 1/4 No. 8, 5/16 and No. 10	22.10 to 33.00	1/4 by 12 in. long	16.60
No. 12		1/4 by 19 in. long	14.00
5/16, No. 14 and 3/16		1/4 by 19 in. long	12.00
No. 18		1/4 by 21 in. long	12.00
No. 20		* Special Welding Wire	
		1/16	33.00
		1/8	30.00
		1/4	38.00

* Very scarce.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Tire	4.14	4.07	4.17
Toe calk	5.75	4.65	4.32
Openhearth spring steel (heavy)	8.00	8.00	7.50
Spring steel (light)	11.00	11.25	11.75
Coppered bessemer rods	9.00	8.90	7.07
Hoop steel	4.745	4.75	4.77
Cold-rolled strip steel	8.50	8.25	8.57
Floor plates	6.245	6.00	6.25

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
1/8, 1/4, and 3/8	44%	17½%	1/8 to 1¼	33%	17%
1/2	48%	33½%			
3/4 to 3	51%	37½%			

LAP WELD

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

BUTT WELD. EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	40%	22½%	1/8 to 1¼	33%	18%
1/2	45%	32½%			
3/4 to 1¼	49%	36½%			

LAP WELD. EXTRA STRONG PLAIN ENDS

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Stock discounts in cities named are as follows:

	New York		Cleveland		Chicago	
	Black	Galvanized	Black	Galvanized	Black	Galvanized
1/8 to 3 in. steel butt welded	35%	16%	41%	26%	41.1%	26.1%
3½ to 3 in. steel lap welded	15%	+3%	37%	23%	37.1%	23.1%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 10 and 5%.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	26.00*	26.00	23.50
Tin in 5-ton lots	78.50	83.00	62.00
Lead	8.05	8.55	8.50
Spelter	9.75	9.50	8.50

* Government price.

ST. LOUIS

Lead	7.75	8.25	8.00
Spelter	9.50	9.25	8.25

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Copper sheets, base	38.00	38.00	35.00	38.00	33.00	38.00	34.00
Copper wire (carload lots)	35.00	35.00	38.50	35.00	33.00	38.00	33.50
Brass sheets	39.75	39.75	*0.00	40.50	33.25	38.00	35.00
Brass pipe	46.00	46.00	43.00	42.50	41.00	44.00	42.00
Solder (half and half) (case lots)	58.00	58.00	39.25	50.50	37.00	65.00	39.00

Note:—Solder very scarce.

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$37.75	$29.00
New York	34.25	35.00
Cleveland	38.50	34.00
Chicago	29.50	37.00

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 15.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	18.7	20.00	18.40	20.50
New York	17.00	21.00	17.50	21.25
Chicago	22.00	21.00	21.50	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	14.00	15.00
Chicago	15.50	16.25
Cleveland	17.125	16.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current 1918	One Year Ago	Current 1918	One Year Ago	Chicago
Copper, heavy and crucible	24.00	24.00	24.00	24.75	22.00
Copper, heavy and wire	22.50	23.00	23.50	24.00	22.25
Copper, light and bottoms	20.50	21.00	21.50	22.00	21.00
Lead, heavy	7.25	8.00		8.00	7.00
Lead, tea	5.50	6.75	7.50	6.00	6.20
Brass, heavy	14.75	15.25	16.50	17.00	21.50
Brass, light	11.00	11.50	12.50	13.00	12.75
No. 1 yellow brass turnings	13.75	16.25	14.00	16.00	15.00
Zinc	6.50	6.00	6.00	6.00	5.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, guaranteed over 99% pure, in ingots for remelting (1-15 ton lots), per lb.	33.20c.	32.30c.	33½c.

This is the Government price for lots of from 1 to 14 tons.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	32.00	41.00
Chicago	38.00	41.00
Cleveland	36.50	39.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	95.00	70.00	93.00	69.75	96.00	70.00
Commercial	50.00	40.00	23.00	24.50	25.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	$2.50*	List	$1.25	$1.65	$0.98	$2.00
Hot pressed hexagon	2.50*	List	1.05	1.50	.78	2.00
Cold punched hexagon	2.50*	List	.75	1.25	1.00	1.50
Cold punched square	2.50*	List	.75	1.25	1.00	1.50

* List plus.

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	50%
Cleveland	50+10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	40+10%	37%
Larger and longer up to 1 in. by 30 in.	15%	20+ 5%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... $2.50 Cleveland..... $1.00 Chicago..... $2.50

For cast-iron washers the base price per 100 lb. is as follows:

New York..... $5.00 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	45%	32½%
Larger and longer up to 1 in. by 30 in	15%	20+5%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	List plus 10%	List plus 10%	List plus 10%	List plus 10%
Chicago	List price	List price	List plus 20%	List price
New York	20% from list	List plus 10%	List plus 20%	10-2½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	30%	45—5%	40%
Tinned	30%	45—5%	40%

Button heads, ½, ⅝, 1 in. diameter by 2 in. to 5 in. sell as follows per 100 lb.

New York..$5.65 Cleveland...$5.15 Chicago....$5.67 Pittsburgh...$4.65

Coneheads, same sizes:

New York...$5.75 Cleveland...$5.25 Chicago....$5.77 Pittsburgh...$4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	51.00	38.00	39.50
Brass	42.00	40.00	44.00

For immediate stock shipment 3c. is usually added. The prices of course vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., the advance is 2½c. over base (100-lb. lots); for less than 50 lb. but not less than 25 lb., 5c. should be added to the base price; and for quantities under 25 lb. the increase above base is 10c.

TIN PLATES—Warehouse prices per box:

Coke tin plate, 14 x 20:

	Cleveland		Chicago	
	Current	One Yr. Ago	Current	One Yr. Ago
100 lb	$9.17½	$12.00	$10.60	$11.75
I. C. 107 lb	9.42½	12.17½	10.70	11.90

Terne plate, 20 x 28:

Base Weight	Net Weight	Coating				
100 lb.	200	3		18.95	18.95	19.10	17.90
I. C.	214	8		19.25	19.25	19.40	18.25
I. C.	270	8		21.75	21.75	21.40	20.35
I. C.	218	12		21.75	21.75	22.60	19.25
I. C.	221	15		22.50	22.50	22.10	19.50
I. C.	226	30		23.25	23.25	22.60	20.50
I. C.	231	25		24.50	24.50	23.10	21.30
I. C.	236	30		25.75	25.75	23.60	22.25
I. C.	241	35		26.75	26.75	25.10	23.25
I. C.	246	40		28.00	28.00	25.60	24.55

NOTE—New York prices furnished on application to dealers. Price varies according to whether the plates are wanted for work essential to the war or for nonessential work.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	12.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 100c is as follows:

	13½ x 13½	13½ x 20½
Cleveland	52.00	58.00
Chicago	48.00	50.00

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.40	2.40	2.10
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$4.30	$4.30	$4.30
Cleveland	4.60	4.60	4.50
Chicago	4.00	4.00	3.80

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past four weeks:

	Oct. 24	Oct. 17	Oct. 10	Oct. 3	Sept. 26
Prompt furnace	$6.00	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Chicago	450-lb. bbl.	$2.50
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

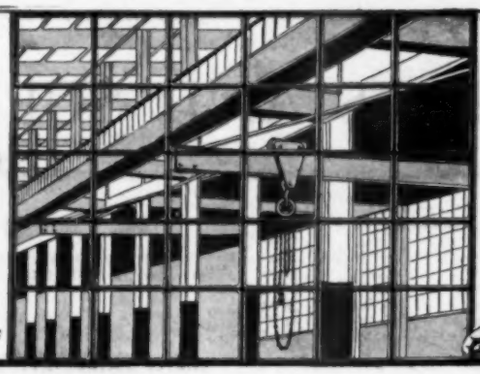
	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels	$1.61	$1.23	$1.85	$1.30	$1.65	$1.27
5-gal. cans	1.71	1.33	2.00	1.40	1.85	1.37

WHITE AND RED LEAD in 500-lb. lots sells as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	14.00	14.50	12.25	12.50	14.00	12.50
25 and 50-lb. kegs	14.25	14.75	12.50	12.75	14.25	12.25
12½-lb. keg	14.50	15.00	12.75	13.00	14.50	12.50
5-lb. cans	.....	.....	14.25	14.00	16.00	14.50
1-lb. cans	.....	.....	14.25	14.50	17.00	14.50

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies



WASHINGTON, D. C.

The Navy aims to give information regarding its purchases to all manufacturers known to be in a position to supply its demand. Owing to the need of prompt action in the cases of all machine tools hereinafter listed, the Navy cannot arrange to permit a postponement of the opening of bids if the manufacturers are able to secure bidding forms and submit their bids prior to date fixed for opening.

In case time does not permit this, it will be appreciated if any manufacturer not receiving information directly regarding these purchases will notify the Purchasing Division, Bureau of Supplies & Accounts, Navy Department, Washington, D. C., in order that the firm's name may be properly listed for all future purchases.

The Bureau of Supplies and Accounts, Navy Department, will soon receive bids furnishing machines and machine tools as follows:

Schedule No. 6538¼, 1 heavy duty saw hack, delivery Washington, D. C.

Schedule No. 6539¼, miscellaneous gap lathes, delivery Washington, D. C.

Schedule No. 6550¼, 2 press arbors, delivery Boston, Mass.

Schedule No. 6579¼, 8 heavy duty lathes, delivery Alexandria, Va.

Schedule No. 6530¼, 9 heavy duty lathes, delivery Alexandria, Va.

Schedule No. 6581¼, 3 sensitive, sliding head drills, delivery Portsmouth, Va.

Schedule No. 6582¼, 3 wire beading machines, adjustable folder, delivery Boston, Mass.

Schedule No. 6583¼, 3 shears, punch, bench and blazing table, delivery Boston, Mass.

Schedule No. 6604¼, 3 bench drills, delivery Norfolk, Va.

Schedule No. 6655¼, miscellaneous twist drills, delivery Puget Sound (Bremerton P. O.).

Schedule No. 6663¼, 3 motor driven lathes, delivery Norfolk, Va.

The Bureau of Yards and Docks, Navy Department, received bids furnishing machines and machine tools as follows:

Schedule No. 5907¼, Class 1289, screw machines, delivery Newport, R. I., from Brown & Sharpe Manufacturing Co., Promenade St., Providence, R. I., $4099.

Schedule No. 6176¼, Class 1306, woodworkers' lathes, delivery Brooklyn, N. Y., from J. A. Fay & Egan Co., John and Front St., Cincinnati, Ohio, $7344, alternate $8144; alternate $12,637; American Woodworking and Machinery Co., 591 Lyell Ave., Rochester, N. Y., $8755; Oliver Machine Co., 50 Church St., New York City, $9016, alternate $8469.

Schedule No. 6186¼, Class 1336, cut-off saw, Class 1337, double arbor saw, delivery Portsmouth, Va., from J. A. Fay & Egan Co., John and Front St., Cincinnati, Ohio (1336) $1058, alternate $1253; Ward Motor Vehicle Co., South Fulton Ave., Mt. Vernon, N. Y., (1336) $1457, alternate $1158; American Woodworking and Machinery Co., 591 Lyell Ave., Rochester, N. Y., (1336) $748; (1337) $746; Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., (1337) $1162, alternate $906; D. Nast Machinery Co., Bourse Bldg., Philadelphia, Penn., (1337) $745; Oliver Machinery Co., 50 Church St., New York City, (1337) $1011, alternate $948; Tannerwitz Works, Grand Rapids, Mich, (1337) $975, alternate $846.

Schedule No. 6253¼, Class 1478, twist drills, delivery Boston, Mass., from Buckeye Twist Drill Co., Alliance, Ohio, $4912; Cleveland Twist Drill Co., Lakeside Ave., Cleveland, Ohio, $4912; Detroit Twist Drill Co., 634-66 West Fort St., Detroit, Mich., $4912; W. E. Duff, 217 North George St. York, Penn., $2758 (part bid).

Schedule No. 6268¼, Class 1497, drill press; Class 1498, bench grinder, Class 1499, patternmakers' lathe, delivery Brooklyn, N. Y., from Fairbanks Co., Colorado Bldg., Washington, D. C., (1497) $636; Manning, Maxwell & Moore, 119 West 40th St., New York City, (1497) $560; Hoefer Manufacturing Co., 155 Chicago St., Freeport, Ill., (1497) $1034; Niles-Bement-Pond, 111 Broadway, New York City, (1497) $755; D. Nast Machinery Co., Bourse Bldg., Philadelphia, Penn., (1497) $555; (1498) $105; H. Prentiss Co., 149 Broadway, New York City, (1497) $1094; Dale Brewster Machine Co., 30 Church St., New York City, (1497) $1083; Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., (1498) $121; American Woodworking and Machinery Co., 591 Lyell St., Rochester, N. Y., $462; Oliver Machine Co., 50 Church St., New York City, $894.

Schedule No. 6175¼, Class 1305, hacksaw blades, delivery Norfolk, Va., from Goodell-Pratt Co., 57 Wells St., Greenfield, Mass., $1000; Hibbard-Spencer Bartlett Co., 303 North State St., Chicago, Ill., $1260; Knickerbocker Supply, 149 Church St., New York City, $972; Montgomery & Co., Inc., 105 Fulton St., New York City, $970; Miller-Falls Co., Miller Falls, Mass., $1080; Smith & Hemenway Co., $855; L. S. Starrett Co., 121 Crescent St., Athol, Mass. $1260; West Haven Manufacturing Co., 25 Elm St., West Haven, Conn., $912.

Schedule No. 6199¼, Class 1361, rope testing machines, delivery Boston, Mass., and Mare Island (Vallejo P. O.), Calif., from Riehle Bros. Testing Machine Co., 1424 North 9th St., Philadelphia, Penn., $6000; Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Penn., $6250.

Schedule No. 6248¼, Class 1472, hand planers, delivery Charleston, S. C., from International Marine Planer Co., Inc., Jacksonville, Fla., $1030; Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., $219, (part bid); Manning, Maxwell & Moore, 119 West 40th St., New York City, $270, (part bid).

Schedule No. 6234¼, Class 1438, mills and cutters delivery f.o.b., from Brown & Sharpe Manufacturing Co., Promenade St., Providence, R. I., $2649; Detroit Twist Drill Co., 634-66 West Fort St., Detroit, Mich., $2169; Illinois Tool Works, 154 East Erie St., Chicago, Ill., $2399, (part bid); Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., $2617; Lincoln Twist Drill Co., Taunton, Mass., $2629; Machine Tool Drill Co., New Bedford, Conn., $2271; National Twist Drill and Tool Co., 1456 Brush St., Detroit, Mich., $3041; Pratt & Whitney Co., 436 Capitol Ave., Hartford, Conn., $1402, $2044; Union Twist Drill Co., 70 Munroe St., Athol, Mass., $2043; National Tool Co., 11200 Madison Ave., Cleveland, Ohio, $1402, $2044; Whitney Manufacturing Co., Bartholomew Ave., Hartford, Conn., $347, (part bid); Barber-Colman Co., River and Loomis St., Rockford, Ill., $2538; L. C. Blanke Co., 10 Thomas St., New York City, $2126.

METAL WORKING

NEW ENGLAND STATES

Con., Hartford—The Pratt & Whitney Co., 436 Capitol Ave., has awarded the contract for the erection of a 1-story, 50 x 120 ft. foundry addition.

Conn., New Britain—The Fafner Bearing Co., Booth Creek, manufacturer of ball bearings, has awarded the contract for the erection of an addition to its machine shop. Estimated cost, $6000.

Conn., New Britain—The Stanley Rule and Level Works, 111 Elm St., plans to build a 1-story, 60 x 140 ft. machine shop. Estimated cost, $25,000.

Mass., Boston—The Trimont Manufacturing Co., 55 Armory St., is having plans prepared for the erection of an addition to its forge shop.

Mass., Dorchester (Boston P. O.)—The Standard Oil Co., 20 Broadway, New York City, has awarded the contract for the erection of a 1-story, 60 x 100 ft. garage.

Mass., Lowell—The Boston & Maine R.R. has awarded the contract for a roundhouse and a repair shop to be erected here. Estimated cost, $40,000. A. B. Corthell, Boston, Ch. Engr.

Mass., Worcester—Sleeper & Hartley Co., 68 Prescott St., manufacturer of wire machinery, has awarded the contract for a 1-story, 60 x 200 ft. factory, to be erected on Chandler St.

R. I., Providence—A. White, 157 Sumter St., sheet metal worker, is having plans prepared by Page & Page, Arch., 87 Weybosset St., for a 2-story, 44 x 54 ft. metal shop.

MIDDLE ATLANTIC STATES

Md., Baltimore—The W. W. Jones Machine Co., Industrial Bldg., recently incorporated plans to establish a plant for the manufacture of automatic and special machinery, and will install $10,000 worth of machine tools. J. M. Jones, Secy.

Md., Baltimore—The United Railways and Electric Co., Continental Bldg., has awarded the contract for a 1 story service station on Carrol and Monroe St.

N. J., Blenheim (Blackwood P. O.)—The Simplex Valve and Meter Co., 625 Wood St., Philadelphia, Penn., manufacturer of valves, meters, etc., has had plans prepared for the erection of a 1-story, 76 x 150 ft. plant here.

N. J., Cape May—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has had plans prepared for the erection of forge, electrical and blacksmith shops and a coppersmith works, here.

N. J., Elizabeth—The Construction Division of the War Department, Washington, D. C., has acquired a 43 acre site here and plans to build a proving ground to include shops, etc. Estimated cost, $110,000.

N. J., Jersey City—The Erie R. R. has awarded the contract for a 2-story, 50 x 60 ft. carpenter shop and a 1-story, 40 x 75 ft. tank shop to be erected on Provost and 11th St. Estimated cost, $35,000. Robins Ripley Co., 50 Church St., New York City, Engr.

N. J., Paterson—McNab & Harlin Manufacturing Co., Straight St., manufacturer of brass and iron goods, etc., is building an extension to its plant.

N. J., Perth Amboy—The Standard Oil Co., 20 Broadway, New York City, is having plans prepared for a 2-story, 40 x 50 ft. factory, here, for the manufacture of cans. H. D. Best Co., Flatiron Bldg., New York City, Arch.

N. J., Phillipsburg—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is having plans prepared for a naval base here, to include an aviation station, shops, etc.

N. J., Phillipsburg—The Ingersoll Rand Co., manufacturer of drills, has awarded the contract for the erection of an 80 x 80 ft. addition to its plant.

N. J., Stewartsville—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is having plans prepared for a naval base here, to include an aviation station, shops, etc.